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TIER II SAMPLING AND ANALYSIS PLAN FOR WEST DITCH AREA GROUNDWATER INFILTRATION INVESTIGATION NAWC TRENTON NJ
6/1/2012
TETRA TECH

Tier II Sampling and Analysis Plan
for
West Ditch Area
Groundwater Infiltration Investigation

Former Naval Air Warfare Center Trenton
Trenton, New Jersey

Naval Facilities Engineering Command
Mid-Atlantic

Contract Number N62470-08-D-1001
Contract Task Order WE47

June 2012

TETRA TECH

Title and Approval Page
(UFP-QAPP Manual Section 2.1)

Final
TIER II SAMPLING AND ANALYSIS PLAN
(Field Sampling Plan and Quality Assurance Project Plan)
June 2012

West Ditch Area Groundwater Infiltration Investigation
Former Naval Air Warfare Center Trenton
Trenton, New Jersey

Prepared for:
Naval Facilities Engineering Command Mid-Atlantic
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Prepared under:
Comprehensive Long-term Environmental Action Navy
Contract Number N62470-08-D-1001
Contract Task Order WE47

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Investigative Organization's Project Quality Assurance (QA) Manager:	T.E. Johnston 7-2-12 Signature/Date Thomas Johnston, PhD, Tetra Tech, Inc.
Lead Organization's Project Manager:	Jeffrey M. Dale 7-3-12 Navy Remedial Project Manager/Date Jeffrey M. Dale, NAVFAC Mid-Atlantic
Regulatory Agency Approval:	Will provide letter after review Case Manager/Date Donna Gaffigan, New Jersey Department of Environmental Protection

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EXECUTIVE SUMMARY

Tetra Tech, Inc. (Tetra Tech) has prepared this Sampling and Analysis Plan (SAP) for a Groundwater Infiltration Investigation in the West Ditch Area (Site 1) at Former Naval Air Warfare Center (NAWC) Trenton located in Trenton, New Jersey (**Figures 1** and **2**). Because of the discharge of contaminated groundwater into the storm sewers, the current remedial action for groundwater fails to meet applicable standards as required in New Jersey Administrative Code (N.J.A.C.) 7:26E-1.3(c), specifically the Minimum Surface Water Remediation Standards identified in N.J.A.C. 7:26D-3. This Groundwater Infiltration Investigation is being conducted under Contract Task Order (CTO) No. WE47, Contract N62470-08-D-1001, Comprehensive Long-term Environmental Action Navy (CLEAN). This investigation will:

- Establish whether soil associated with a planned excavation of a corrugated metal pipe (CMP) sewer line is a source of site-related contaminants of concern (COCs) in groundwater that is currently discharging to surface water.
- Establish whether soil to be excavated would be classified as a hazardous waste upon excavation.
- Support evaluation of remedial steps to reduce the discharge of contaminated groundwater in the West Ditch Area into downgradient storm sewers and ultimately into the Gold Run surface water body.
- Evaluate potential changes to the hydrogeological regime at the site that could result from implementation of the proposed remedial actions. Determine the new migration pathway for contaminated groundwater that was flowing into the CMP and will not flow into the CMP upon rehabilitation of the CMP.

NAWC Trenton was primarily used as a testing facility for military aircraft engine performance under simulated high and low altitude conditions. Three large buildings comprised the experimental engine laboratory: the Blower Wing (Building 40), the Test Wing (Building 41), and the Exhauster Wing (Building 42).

Following operational closure of NAWC Trenton in 1998, the facility was subdivided into four parcels (see **Figure 1**). Parcel A encompasses a portion of the Trenton-Mercer Airport which is owned and operated by the County of Mercer Airport Administration. Nineteen monitoring wells included in the Long-Term Monitoring (LTM) program are located on this parcel. Parcel B is owned by N&H Mercer

Realty/Nassimi Realty, a development company that has plans for future long-term commercial use of the site. The primary source areas for the groundwater contamination are located within this parcel and the Navy has installed 15 overburden and bedrock extraction and monitoring wells for capture and containment of impacted groundwater. A groundwater treatment plant is located in the southwest corner of Parcel B. Parcel C as shown on **Figure 1** is a 9.5-acre parcel located on the southeast corner of the former NAWC facility. It is owned by 1400 Parkway LLC for expected future development for commercial and residential uses. Parcel D is approximately 1 acre in size and is owned by the Township of Ewing, New Jersey. At this time, there are no long-term development plans for this portion of the former facility.

A Remedial Investigation (RI) conducted by the Navy from 1992 to 1993 identified chlorinated volatile organic compounds (VOCs), in particular trichloroethene (TCE) and its degradation products, cis- and trans-1,2-dichloroethene (1,2-DCE) and vinyl chloride (VC), as primary groundwater COCs representing contaminants that are most widely detected at the greatest concentrations compared to applicable criteria. Sites 1 and 3 were identified as the two major groundwater source areas. Groundwater contaminated with TCE and VC was also found to be discharging to an intermittent stream/stormwater culvert located immediately west of Building 40 (West End Drainage Ditch). To control this discharge, the Navy installed an Interim Remedial Action system to extract groundwater from MW-15BR and to treat the extracted water to meet applicable water quality standards.

Based on the RI findings and a Focused Feasibility Study (FFS) for groundwater, the Navy, in agreement with the New Jersey Department of Environmental Protection (NJDEP) and the United States Environmental Protection Agency (USEPA), selected comprehensive groundwater recovery and monitored natural attenuation (MNA) as the remedy for NAWC Trenton. The elements of the selected remedy included expansion and operation of the pump-and-treat system to recover contaminated groundwater, discharge of treated groundwater to the ancestral west branch of Gold Run, LTM of groundwater for evaluation of plume extent and system performance, establishment of a Classification Exception Area (CEA) for the area of groundwater that exceeds NJDEP Groundwater Quality Standards (GWQS), establishment of a Well Restriction Area (WRA) to prevent the potable use of impacted groundwater, and the completion of five-year reviews.

There continues to be a concern that the groundwater in the overburden is infiltrating the storm sewer system. Consequently, in May 2010, the NJDEP notified the Navy that while the Navy has taken various actions to identify, isolate, and stop the discharge of contaminated groundwater to the storm sewers and Gold Run, the Navy must identify technologies for remediation of the groundwater infiltration problem. This SAP governs the activities needed to evaluate and recommend an appropriate remedial action. Groundwater samples will be collected from monitoring wells and piezometers for analysis of VOCs and metals parameters. Surface water samples will be collected from the storm sewer manholes and outfalls for analysis of VOCs. Excavation of a 36-inch CMP storm sewer pipe is planned within the West Ditch. The surrounding soil, which may be a contaminant source, is planned for excavation in conjunction with pipe removal. Soil will characterized for waste disposal in advance of excavation by collecting and analyzing soil samples from the planned excavation area. The soil samples will be analyzed for total VOCs and metals and, if required as described in this SAP, for Toxicity Characteristic Leaching Procedure (TCLP) VOCs and metals. The groundwater, surface water, and soil samples will be analyzed by analytical methods with sufficient sensitivity to provide the detection limits required for comparison of results to applicable screening values, which are identified as the Project Action Limits (PALs) and represent concentrations protective of human health.

This SAP was generated for, and complies with, applicable United States Navy, NJDEP, and USEPA Region 2 requirements, regulations, guidance, and technical standards, as appropriate. This includes the Department of Defense (DoD), Department of Energy (DOE), and USEPA Intergovernmental Data Quality Task Force (IDQTF) environmental requirements regarding federal facilities. To comply with IDQTF requirements, the SAP is presented in the format of standard worksheets as specified in the Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) guidance document (USEPA, 2005), and revised in accordance with the Navy Tier II format. This SAP is being prepared by Tetra Tech for tasks that Tetra Tech will implement, as well as tasks that will be performed by the Navy's Operations and Maintenance (O&M) Contractor, Watermark Environmental, Inc. (Watermark) for LTM and other project-related activities.

This SAP outlines the organization, project management, objectives, planned activities, measurement, data acquisition, assessment, oversight, and data review procedures associated with the planned investigations at the West Ditch Area. Protocols for sample collection, handling and storage, chain-of-custody, laboratory and field analyses, data validation, and reporting are also addressed in this SAP. The procedures utilized will comply with specific referenced sections of the NJDEP Field Sampling Procedures Manual (FSPM) (NJDEP, 2005). The field work and sampling are anticipated to begin in August 2011.

SAP Worksheets **Page No.**

LIST OF FIGURES

LIST OF APPENDICES

ACRONYMS AND ABBREVIATIONS

°C	Degrees Celsius
%D	Percent Difference or Percent Drift
%R	Percent Recovery
1,2-DCE	1,2-Dichloroethene
BEC	BRAC Environmental Coordinator
bgs	Below Ground Surface
BRAC	Base Realignment and Closure
CA	Corrective Action
CAS	Chemical Abstracts Service
CEA	Classification Exception Area
CFR	Code of Federal Regulations
CIPP	Cured-in-Place Pipe
CLEAN	Comprehensive Long-term Environmental Action Navy
CLP	Contract Laboratory Program
CMP	Corrugated Metal Pipe
COC	Contaminant of Concern
CSM	Conceptual Site Model
CTO	Contract Task Order
CVAA	Cold Vapor Atomic Absorption
DL	Detection Limit
DoD	Department of Defense
DOE	Department of Energy
DO	Dissolved Oxygen
DNAPL	Dense Non-Aqueous Phase Liquid
DQI	Data Quality Indicator
DQO	Data Quality Objective
DVM	Data Validation Manager
EDD	Electronic Data Deliverable
ELAP	Environmental Laboratory Accreditation Program
FFS	Focused Feasibility Study
FID	Flame Ionization Detector

ACRONYMS AND ABBREVIATIONS (Continued)

FOL	Field Operations Leader
FSPM	Field Sampling Procedures Manual
FTMR	Field Task Modification Request
g	Gram
GC/MS	Gas Chromatograph/Mass Spectrometer
GMC	General Motors Corporation
GIS	Geographic Information System
gpm	Gallons per Minute
GPS	Global Positioning System
GWQS	Groundwater Quality Standard
GWTP	Groundwater Treatment Plant
HAZWOPER	Hazardous Waste Operations and Emergency Response
HASP	Health and Safety Plan
HCl	Hydrochloric Acid
HNO_3	Nitric Acid
HSA	Hollow Stem Auger
HSM	Health and Safety Manager
IAS	Initial Assessment Study
ICAL	Initial Calibration
ICP-AES	Inductively Coupled Plasma-Atomic Emission Spectrometer
ICP-MS	Inductively Coupled Plasma-Mass Spectrometer
IDQTF	Intergovernmental Data Quality Task Force
IDW	Investigation-Derived Waste
IS	Internal Standard
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
LOD	Limit of Detection
LOQ	Limit of Quantitation
LTM	Long-Term Monitoring
MCL	Maximum Contaminant Level
MD	Matrix Duplicate
mg/kg	Milligrams per Kilogram
mg/L	Milligrams per Liter
mL	Milliliter

ACRONYMS AND ABBREVIATIONS (Continued)

MNA	Monitored Natural Attenuation
MPC	Measurement Performance Criterion
MS	Matrix Spike
MSD	Matrix Spike Duplicate
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NA	Not Applicable
NAD83	North American Datum of 1983
NAVD88	North American Vertical Datum of 1988
NAWC	Naval Air Warfare Center
NAVFAC	Naval Facilities Engineering Command
Navy	United States Department of the Navy
NC	No Criteria
NE	Northeast
NEDD	NIRIS Electronic Data Deliverable
NELAP	National Environmental Laboratory Accreditation Program
NIRIS	Naval Installation Restoration Information Solution
N.J.A.C.	New Jersey Administrative Code
NJDEP	New Jersey Department of Environmental Protection
NPDES	National Pollutant Discharge Elimination System
O&M	Operations and Maintenance
ORP	Oxidation Reduction Potential
OSHA	Occupational Safety and Health Administration
oz	Ounce
PAL	Project Action Limit
PCE	Tetrachloroethene
PDB	Passive Diffusion Bag
PID	Photoionization Detector
PM	Project Manager
POC	Point of Contact
PPE	Personal Protective Equipment
PQL	Practical Quantitation Limit
PQLG	Practical Quantitation Limit Goal

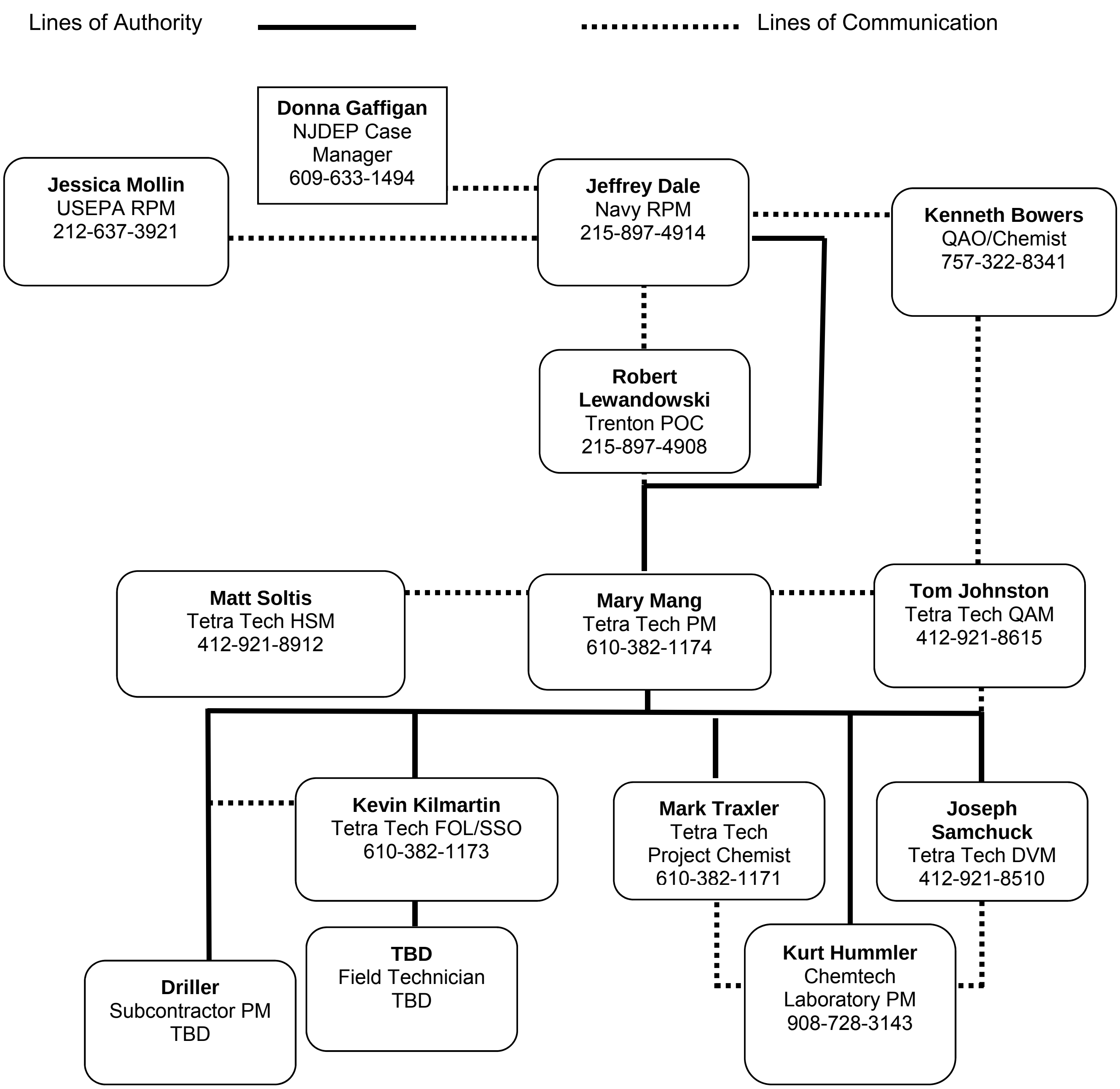
ACRONYMS AND ABBREVIATIONS (Continued)

PVC	Polyvinyl Chloride
QA	Quality Assurance
QAM	Quality Assurance Manager
QAO	Quality Assurance Officer
QC	Quality Control
QSM	Quality Systems Manual
RAR	Remedial Action Report
RDCSRS	Residential Direct Contact Soil Remediation Standard
RGH	Rogers, Golden, and Halpern
RI	Remedial Investigation
RPD	Relative Percent Difference
RPM	Remedial Project Manager
RSD	Relative Standard Deviation
RT	Retention Time
SAP	Sampling and Analysis Plan
SI	Site Inspection
SOP	Standard Operating Procedure
SQL	Structured Query Language
SSO	Site Safety Officer
SVOC	Semivolatile Organic Compound
SWQS	Surface Water Quality Standard
TBD	To Be Determined
TCE	Trichloroethene
TCLP	Toxicity Characteristic Leaching Procedure
Tetra Tech	Tetra Tech, Inc.
UFP-QAPP	Uniform Federal Policy Quality Assurance Project Plan
µg/L	Micrograms per Liter
USCS	Unified Soil Classification System
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
VC	Vinyl Chloride
VOC	Volatile Organic Compound
Watermark	Watermark Environmental, Inc.

ACRONYMS AND ABBREVIATIONS (Continued)

WDW	West Ditch Well
WRA	Well Restriction Area
ZHE	Zero Headspace Extractor

1.0 -- Project Organizational Chart
(UFP-QAPP Manual Section 2.4.1 – Worksheet #5)



DVM - Data Validation Manager
FOL - Field Operation Leader
HSM - Health and Safety Manager
Navy – United States Department of the Navy
NJDEP - New Jersey Department of Environmental Protection
PM - Project Manager
POC - Point of Contact
QAM - Quality Assurance Manager
QAO - Quality Assurance Officer
RPM - Remedial Project Manager
SSO - Site Safety Officer
TBD - To Be Determined
Tetra Tech -Tetra Tech, Inc.
USEPA - United States Environmental Protection Agency
Watermark - Watermark Environmental, Inc.

Tetra Tech will conduct short-term monitoring tasks utilizing the personnel identified above. Long-term monitoring (LTM) tasks will be performed by the Navy's on-site Operations and Maintenance (O&M) Contractor, Watermark.

2.0 -- Communication Pathways
(UFP-QAPP Manual Section 2.4.2 – Worksheet #6)

The communication pathways for the Sampling and Analysis Plan (SAP) are shown below.

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathway To/From, etc.)
Regulatory Agency Interface	USEPA RPM NJDEP Case Manager Navy RPM	Jessica Mollin Donna Gaffigan Jeffrey Dale	212-637-3921 609-633-1494 215-897-4914	The Navy RPM will contact each regulatory agency via phone and/or e-mail within 24 hours of recognizing the issue whenever issues arise.
Gaining Site Access	USGS (Water levels) USGS (PDB and MNA) Navy RPM	Pierre Lacombe Tom Imbrigiotta Jeffrey Dale	609-771-3942 609-771-3914 215-897-4914	United States Geological Survey (USGS) personnel and Navy RPM must be contacted verbally or via e-mail at least 2 weeks prior to work at Naval Air Warfare Center (NAWC) Trenton.
Obtaining Utility Clearances for Intrusive Activities	Tetra Tech FOL Navy RPM Driller Subcontractor	Kevin Kilmartin Jeffrey Dale TBD	610-382-1173 215-897-4914 TBD	The Tetra Tech FOL will coordinate verbally or via e-mail with Navy RPM at least 7 days in advance of site access and with a Tetra Tech drilling subcontractor at least 3 days in advance of any intrusive activities for the utility clearance of all well boring locations. The Tetra Tech subcontractor will verbally coordinate utility clearance with the New Jersey One-Call system at least 3 days prior to drilling.
Stop Work due to Safety Issues	Tetra Tech SSO Tetra Tech PM Tetra Tech HSM Navy RPM	Kevin Kilmartin Mary Mang Matt Soltis Jeffrey Dale	610-382-1173 610-382-1174 412-921-8612 215-897-4914	If Tetra Tech is the responsible party for a stop work command, the Tetra Tech SSO will inform on-site personnel, subcontractor(s), the Navy RPM, and the identified Project Team members within 1 hour (verbally or by e-mail). If a subcontractor is the responsible party, the subcontractor PM must verbally inform the Tetra Tech SSO within 15 minutes, and the Tetra Tech SSO will then follow the procedure described above.
SAP Changes Prior to Field/ Laboratory Work	Tetra Tech FOL/SSO Tetra Tech PM Navy RPM	Kevin Kilmartin Mary Mang Jeffrey Dale	610-382-1173 610-382-1174 215-897-4914	The Tetra Tech PM will document the proposed changes via a Field Task Modification Request (FTMR) form within 5 days and send the Navy RPM a concurrence letter within 7 days of identifying the need for change if necessary. SAP amendments will be submitted by the Tetra Tech PM to the Navy RPM for review and approval. The Tetra Tech PM will send scope changes to the Project Team via e-mail within 1 business day.

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathway To/From, etc.)
SAP Changes in the Field	Tetra Tech FOL/SSO Tetra Tech PM Navy RPM	Kevin Kilmartin Mary Mang Jeffrey Dale	610-382-1173 610-382-1174 215-897-4914	The Tetra Tech FOL will verbally inform the Tetra Tech PM on the day that the issue is discovered. The Tetra Tech PM will inform the Navy RPM (verbally or via e-mail) within 1 business day of discovery. The Navy RPM will issue a scope change (verbally or via e-mail), if warranted. The scope change is to be implemented before further work is executed. The Tetra Tech PM will document the change via an FTMR form within 2 days of identifying the need for change and will obtain required approvals within 5 days of initiating the form.
Field Corrective Actions	Tetra Tech PM Tetra Tech QAM Navy RPM	Mary Mang Tom Johnston Jeffrey Dale	610-382-1174 412-921-8615 215-897-4914	The Tetra Tech QAM will notify the Tetra Tech PM verbally or by e-mail within one business day that the corrective action has been completed. The Tetra Tech PM will then notify the Navy RPM (verbally or by e-mail) within 1 business day.
Sample Receipt Variances	Chemtech Laboratory PM Tetra Tech FOL Tetra Tech PM	Kurt Hummler Kevin Kilmartin Mary Mang	908-728-3143 610-382-1173 610-382-1174	The Laboratory PM will notify (verbally or via e-mail) the Tetra Tech FOL immediately upon receipt of any chain of custody/sample receipt variances for clarification or direction from the Tetra Tech FOL. The Tetra Tech FOL will notify (verbally or via e-mail) the Tetra Tech PM within 1 business day, if corrective action is required. The Tetra Tech PM will notify (verbally or via e-mail) the Laboratory PM and the Tetra Tech FOL within 1 business day of any required corrective action.
Reporting Laboratory Quality Variances	Chemtech Laboratory PM Tetra Tech Project Chemist Tetra Tech PM Tetra Tech FOL Chemtech Laboratory QAM	Kurt Hummler Mark Traxler Mary Mang Kevin Kilmartin Krupa Dubey	908-728-3143 610-382-1171 610-382-1774 610-382-1173 908-728-3152	Any planned SOP variances from the quality elements specified in the Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 4.1 (April 2009) are identified in **Worksheet #10.0**. The Laboratory PM will notify (verbally or via e-mail) the Tetra Tech Project Chemist of any variance from the quality limits identified in this SAP on the day that the variance becomes known. The Tetra Tech Project Chemist will notify (verbally or via e-mail) the Tetra Tech PM within 1 business day of the need for corrective action, if the variance is a significant issue. The Tetra Tech PM will notify (verbally or via e-mail) the Laboratory PM and the Tetra Tech FOL and Project Chemist

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathway To/From, etc.)
				within 1 business day of any required corrective action. The Laboratory QAM will document all quality variances in the Case Narrative of the Analytical Laboratory Report.
Reporting Concerns Involving Laboratory Performance	Tetra Tech Project Chemist Tetra Tech PM Tetra Tech FOL Chemtech Laboratory PM	Mark Traxler Mary Mang Kevin Kilmartin Kurt Hummler	610-382-1171 610-382-1174 610-382-1173 908-728-3143	If reported analytical results are inconsistent with the planned details identified in this SAP, the Tetra Tech Project Chemist will notify (verbally or via e-mail) the Tetra Tech PM within 1 business day of identifying a concern to determine if corrective action is needed. The Tetra Tech PM will notify (verbally or via e-mail) the Laboratory PM and the Tetra Tech FOL and Project Chemist within 1 business day of any required corrective action.
Notification of Non-Usable Data	Chemtech Laboratory PM Tetra Tech Project Chemist Tetra Tech DVM Tetra Tech PM	Kurt Hummler Mark Traxler Joseph Samchuck Mary Mang	908-728-3143 610-382-1171 412-921-8510 610-382-1174	If the laboratory determines that any data they have generated is non-usable, the Laboratory PM will notify (verbally or via e-mail) the Tetra Tech Project Chemist within 1 business day of when the issue is discovered. The Tetra Tech Project Chemist will notify (verbally or via e-mail) the Tetra Tech DVM and the Tetra Tech PM within 1 business day of the need for corrective action, if the non-usable data is a significant issue (i.e., critical sample data). Corrective action may include resampling and/or reanalyzing the effected samples. If a Tetra Tech Data Validator identifies non-usable data during the data validation process, the Tetra Tech DVM will notify the Tetra Tech PM verbally or via e-mail within 48 hours of validation completion that a non-routine and significant laboratory quality deficiency has resulted in non-usable data. The Tetra Tech PM will take corrective action appropriate for the identified deficiency to ensure the project objectives are met.

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathway To/From, etc.)
Analytical Corrective Actions and Reporting Data Validation Issues	Chemtech Laboratory PM Tetra Tech Project Chemist Tetra Tech DVM Tetra Tech PM Navy RPM	Kurt Hummler Mark Traxler Joseph Samchuck Mary Mang Jeffrey Dale	908-728-3143 610-382-1171 412-921-8510 610-382-1174 215-897-4914	The Laboratory PM will notify (verbally or via e-mail) the Tetra Tech Project Chemist within 1 business day of when an issue related to laboratory data is discovered. The Tetra Tech Project Chemist will notify (verbally or via e-mail) the DVM and the Tetra Tech PM within 1 business day. Tetra Tech DVM or Project Chemist will notify the Tetra Tech PM verbally or via e-mail within 48 hours of validation completion that a non-routine and significant laboratory quality deficiency has been detected that could affect this project and/or other projects. The Tetra Tech PM will verbally advise the Navy RPM within 24 hours of notification from the Tetra Tech DVM or Project Chemist. The Navy RPM will take corrective action appropriate for the identified deficiency. Examples of significant laboratory deficiencies include data reported that has a corresponding failed mass spectrometer tune or initial calibration verification. Corrective actions may include a consult with the Navy Chemist.
Data Validation Corrective Actions	Tetra Tech DVM Tetra Tech PM	Joseph Samchuck Mary Mang	412-921-8510 610-382-1174	See "Notification of Non-Usable Data" procedure above. If a Tetra Tech Data Validator identifies non-usable data during the data validation process that requires corrective action, the Tetra Tech PM will coordinate with the Tetra Tech DVM to take corrective action appropriate for the identified deficiency to ensure the project objectives are met. Corrective action may include resampling and/or reanalyzing the effected samples, as determined by the Tetra Tech PM.

PDB – Passive Diffusion Bag
MNA – Monitored Natural Attenuation

Communication pathways listed above identify Tetra Tech personnel for Tetra Tech directed activities, including soil sampling. For LTM activities, including groundwater and surface water sampling, the O&M Contractor (Watermark) LTM SAP identifies their appropriate personnel and, if the communication processes differ from those described on this Worksheet, will describe the applicable procedures to include the personnel that must communicate, the timing of communication, and the mechanism of communication.

3.0 -- Project Planning Session Participants Sheet
(UFP-QAPP Manual Section 2.5.1 – Worksheet #9)

Project Name: Groundwater Infiltration Investigation Projected Date(s) of Sampling: Fall 2011 to Fall 2012 Project Manager: Mary Mang	Site Name: NAWC Trenton Site Location: Trenton, New Jersey				
Date of Session: Scope of activities has been outlined in various letters and reports prepared by the Navy and NJDEP. **Scoping Session Purpose:** See Above.					
Name	**Title**	**Affiliation**	**Phone #**	**E-mail Address**	**Project Role**
Robert Lewandowski	BRAC Environmental Coordinator (BEC)	Navy	215-897-4908	robert.f.lewandowski@navy.mil	BEC
Jeffrey Dale	RPM	Navy	215-897-4914	jeffery.m.dale@navy.mil	RPM
Donna Gaffigan	Case Manager	NJDEP	609-633-1494	donna.gaffigan@dep.state.nj.us	NA
Mary Mang	PM	Tetra Tech	610-382-1174	mary.mang@tetratech.com	PM
Mark Traxler	Environmental Scientist	Tetra Tech	610-382-1171	mark.traxler@tetratech.com	Chemist
Kevin Kilmartin	Geologist	Tetra Tech	610-382-1173	kevin.kilmartin@tetratech.com	Geologist

Comments/Decisions: This SAP is being prepared as outlined in correspondence between the Navy and NJDEP. Both parties have agreed to the specific activities which are addressed in this SAP.

Action Items: Tetra Tech will prepare a SAP in the Navy's Tier II format.

Consensus Decisions: To address this issue, in a letter dated May 24, 2010, the NJDEP required that the Navy submit a Remedial Action Report (RAR), and that the Navy submit a remedial action selection report following submittal of the RAR. The Navy submitted the RAR on September 24, 2010. On December 20, 2010, the Navy notified the NJDEP of the remedial steps that the Navy would perform to reduce the discharge of contaminated groundwater into the storm sewers and Gold Run, and also outlined additional site investigation efforts that would be required to identify the source of the site-related contaminants of concern (COCs) and to evaluate any potential changes to the site's hydrogeological regime that would result from the remedial action (see **Appendix A**). The NJDEP approved this plan in a letter to the Navy dated March 1, 2011 (see **Appendix A**). This SAP will govern the characterization of soil along the West Ditch storm sewer prior to a planned excavation of the sewer pipe to support waste disposal. This SAP also will govern characterizations required to document the effectiveness of remedial activities associated with the discharge of volatile organic compound (VOC)- and metal-contaminated groundwater or storm water that is originating from beneath the former NAWC Trenton property and entering a Navy-dedicated storm sewer that parallels Parkway Avenue, and ultimately into the Gold Run surface water body. Specific activities to be implemented by Tetra Tech or other organizations have been agreed to by NJDEP and include:

1. Video survey of the West Ditch 36-inch corrugated metal pipe (CMP) from its headwall downstream (southward) to Manhole 140 and the subsequent repair/replacement of the damaged section (conducted as a separate project from the investigation that is addressed in this SAP).

2. Video survey of the steel pipe (unknown diameter) extending from the former Oil/Water Separator to Outfall 1 to evaluate its condition and determine whether additional infiltration is occurring along the furthest downgradient portion of the West Ditch (conducted by a Navy contractor separate from soil and groundwater sampling).

3. Characterization of VOC and metal concentrations in the vicinity of the West Ditch for purposes described above.

4. Installation of piezometers in the West Ditch backfill and quarterly monitoring for a period of one year after remedial activities are completed to determine groundwater elevations and the volume and quality of groundwater migrating into this proposed high permeability medium in the West Ditch Area for potential changes to the hydrogeological regime.

5. Quarterly monitoring for a period of one year after remedial activities are completed of existing overburden groundwater monitoring wells for water levels and water quality and existing surface water manholes and outfalls for water levels/flows and water quality to determine if repairs to the CMP have altered hydraulic conditions in the vicinity of the West Ditch and created a new migration pathway through the overburden material, and to address data gaps identified in the NJDEP letter response.

4.0 -- Conceptual Site Model

(UFP-QAPP Manual Section 2.5.2 – Worksheet #10)

4.1 FACILITY DESCRIPTION AND BACKGROUND INFORMATION

The former NAWC facility is located 5 miles northwest of Trenton, New Jersey in Ewing Township, Mercer County (**Figure 1**). The facility, when owned and operated by the Navy, consisted of approximately 67 acres. NAWC Trenton can be found on the USGS Pennington and Trenton West 7.5-minute topographic maps. As shown on **Figure 1**, the Mercer County Airport borders most of the northern and western portions of the former NAWC Trenton property. An active rail line owned by CSX Transportation, Inc. borders the site on the east and separates Parcel C (former Buildings 1 and 2) from the remainder of the facility. Parkway Avenue abuts the southern boundary of the NAWC Trenton property. Across Parkway Avenue and east of the railroad is an empty parcel where General Motors Corporation (GMC)-Delphi Interior formerly operated a manufacturing facility. East of the former GMC site is Gold Run stream and three associated ponds which drain southwesterly to the Delaware River. South of Parkway Avenue and west of the railroad tracks are several small commercial facilities. Residential and light-industrial areas are located further south and southwest of the NAWC Trenton facility.

NAWC Trenton was commissioned in 1951 as the Naval Air Turbine Test Station. NAWC Trenton was primarily used as a testing facility for military aircraft engine performance under simulated high and low altitude conditions. Three large buildings (see **Figure 2**) formerly comprised the experimental engine laboratory: the Blower Wing (Building 40), the Test Wing (Building 41), and the Exhauster Wing (Building 42). By the mid-1980s, construction of missile-related test equipment became a priority at the site. An on-site industrial wastewater treatment plant, three high-capacity water cooling towers, an automotive workshop, a machine shop, a woodworking shop, fuel and lubrication laboratories, a general chemistry laboratory, and various engineering and administrative offices were also located at the facility. Industrial wastewaters from former site operations were diverted through a central piping system to a 52-feet deep gravity basin, located between Buildings 41 and 42, known as the Barometric Well (**Figure 2**). The Navy decommissioned the Barometric Well in May 1998, at which time the concrete well vault was filled with gravel and capped with concrete, and the related piping was cut and sealed.

Operational closure of NAWC Trenton occurred on December 15, 1998 under the Base Realignment and Closure (BRAC) Act of 1993. Several large buildings currently remain in place; however, they were decommissioned and cleaned as necessary by the Navy as part of the 1998 closure activities and there are no active utility hookups between the various buildings that remain at the site. Former macadam paved areas and driveways remain. Overgrown bushes and grasses are present in those areas that were formerly grass-covered. The building housing the groundwater treatment plant (GWTP) equipment was added in 1995.

Environmental investigations have been conducted by the Navy at NAWC Trenton since the mid-1980s. In 1986, Rogers, Golden, and Halpern (RGH) completed a preliminary investigation that identified seven areas (Sites 1 through 7) of potential concern and recommended further investigation (RGH, 1986). Site 1 is located in the southwest corner of the NAWC Trenton facility between Buildings 40 and 41 (the Blower Wing and West Wing, respectively) and the West-end Drainage Ditch, hereafter also referred to as the West Ditch or West Ditch Area (**Figure 2**). From 1951 to 1957, liquid solvents and heat exchange fluids were used for various operations conducted in a rectangular-shaped area between Buildings 40 and 41, known as the Brine Handling Area and subsequently, drained into the West-end Drainage Ditch. The Brine Handling Area measures approximately 150 feet by 300 feet and is a flat, vegetated covered area. The West Ditch was a rectangular open swale approximately 25 feet wide and 400 feet long that collects surface water runoff from various portions of the facility including the Brine Handling Area. In 1970, the Navy installed a corrugated metal sewer pipe and overlying backfill within a major portion of the open swale. Groundwater and soil sampling was conducted during the initial site inspection (SI) and the remedial investigation (RI) of Site 1. Based on the RI, it was determined that soil located within Site 1 exceeded NJDEP soil cleanup criteria for select VOCs, semivolatile organic compounds (SVOCs), and inorganic compounds. Sampling results also indicated that groundwater beneath the site might be contaminated from the various soil contaminants. In 1998, the Navy elected to excavate the most contaminated soil for Site 1, specifically between Buildings 40 and 41, and towards Building 48, from the existing ground surface to the top of bedrock or groundwater (approximately 6 to 8 feet below grade). Following backfilling, a vegetated soil cap was installed over the remaining areas of the site to limit potential for direct contact.

A Reuse Plan for NAWC Trenton was approved on July 15, 1996 and property ownership was transferred by parcel between 1997 and 2001. Section 4.5 details the current ownership and parcel layout (Parcels A through D) of the former facility. The Navy has in place agreements and easements with each of the current site owners to allow for access to the site, including a number of capped impacted soil areas, groundwater monitoring and extraction wells, outfalls, associated piping, and the on-site GWTP building. A chain-link fence borders the site on most sides; however, a portion of Parcel A is owned and contained within the active Trenton-Mercer Airport and the fence was removed there and replaced with a new fence along the new southern boundary of the Airport property. The fence along the south and east side of the East campus has been removed. Future land use at the site will consist of light industrial or commercial activities and potential residential use of Parcel C. As of 2009, no active development activities are occurring. As construction occurs, the Navy will negotiate with the parcel owners the need for any changes to the location of monitoring and extraction wells to maintain the effectiveness of the groundwater extraction and treatment system.

4.1.1 Hydrogeology

The unconsolidated overburden soil at former NAWC Trenton consists of natural alluvial deposits, in situ weathered rock, and fill from an undetermined source(s). The area has been altered by excavation, filling, construction, and other disturbances. The overburden is thickest in the northern portion of the site and is thinnest near the base of a slope created during terracing of the NAWC property. Excavated fill or overburden removed during the terracing was deposited in the southern portion of the site, ranging from approximately 6 to 22 feet in depth. Average depth to weathered bedrock is approximately 5 to 30 feet below ground surface (bgs), and average depth to competent bedrock is from 30 to 60 feet bgs.

Bedrock beneath NAWC Trenton is composed of the upper strata of the Stockton Formation and the middle strata of the Lockatong Formation (a fractured bedrock aquifer). Based on the lithology observed in bedrock cores collected on-site, the USGS identified a bedrock high angle fault across the southern portion of NAWC Trenton. The USGS interpreted that the fault zone acts as a hydrologic confining unit at depth (i.e., separating groundwater flow on the north side of the fault from groundwater flow on the south side of the fault). Bedrock in the area of the fault can be as much as 80 feet bgs, with the greatest depth occurring in the southwest corner of the site. The hydraulic gradient in the bedrock aquifer is southward toward the west branch of Gold Run, but the groundwater flow direction is westward toward the spring.

Depth to groundwater ranges from approximately 3 to 16 feet bgs and varies due to seasonal fluctuations, precipitation events, and changes in the groundwater extraction scheme. Bedrock groundwater flow occurs mainly in partings parallel to bedding and in vertical fractures. The general groundwater flow gradient is to the south-southeast; however, local groundwater flow depends upon the orientation of the fractures within the bedrock.

The occurrence of groundwater in the overburden is highly variable and fluctuates by location and by time. In the vicinity of Site 1, the overburden is typically at least partially saturated in the northern portion of the site where the overburden is thickest (for example, at the spring and near monitoring well MW-1S shown on **Figure 4**), but monitoring wells in the southern portion of the site, where the overburden thins, are either chronically dry (MW-4S) or contain groundwater only during the wetter months of the year (MW-40S, MW-41S).

Current research by the USGS indicates that the discharge of the spring varies by season and by meteorological events. During non-summer months, flow from the spring ranges between about

10 to 20 gallons per minute (gpm), although it can exceed 25 gpm two to four days after significant storms. During the summer months, the flow rate decreases to 5 gpm or less, and during drier intervals the spring can go dry and flow will cease. Water levels in MW-1S indicate that the water table is typically about 4 to 5 feet below the ground surface, but a heavy rain will cause the static water level to rise within about 0.5 foot of the ground surface (USGS, unpublished internal data).

4.1.2 Storm Water and Surface Water Drainage

There are no permanent surface water bodies on the former NAWC Trenton property. The ancestral West Branch Gold Run runs underneath Parkway Avenue, along the southern boundary of the facility (**Figure 3**). Gold Run originates as an intermittent spring in a wooded area located approximately 200 feet west of the facility. Gold Run enters a municipal storm sewer line that was constructed to follow the original stream bed and runs under the south side of Parkway Avenue, and is usually referred to as the Gold Run Line. The Gold Run Line is made of variable construction ranging from a 3-foot by 4-foot flume to a circular, 24-inch reinforced concrete pipe. Water in this line flows approximately 2,100 feet to the east, where it ties into a second sewer line (the Navy Line, discussed below) before discharging to surface water at an outfall (GR-OF) on the south side of Parkway Avenue, just east of the former GMC plant.

Surface water drainage at the former NAWC Trenton (west of the rail tracks) is controlled by a series of storm water catch drains and underground piping that direct the collected stormwater into four primary collection and drainage pipes referred to as Outfall 1 through Outfall 4 (see **Figure 4**). The four outfalls discharge directly into a Navy-dedicated storm drain that begins just west of the facility and is located beneath the northern side of Parkway Avenue. This Navy-dedicated storm drain eventually drains into the storm drain located beneath the southern side of Parkway Avenue (the culverted ancestral west branch of Gold Run) just upstream of outfall GR-OF for combined flow into Gold Run.

Downstream of the outfall GR-OF, the combined water from both storm drain lines exits on the eastern side of the former GMC site and continues as a north-to-south flowing, aboveground stream south of Parkway Avenue that leads to the Delaware River. Gold Run also receives surface water runoff from several off-site sources in addition to NAWC Trenton.

As described in Section 4.1.1, a spring emanating above the northern end of the West Ditch open swale in the northwestern corner of the property flows overland for a short distance before entering the 36-inch CMP culvert that is the main collection pipe of the Outfall 1 drainage system (**Figure 5**). This open ditch and main collection pipe are referred to as the West Ditch. The West Ditch can be accessed approximately 275 feet downgradient of its headwall through Manhole 140 (**Figure 6**), which marks the location where a stormwater lateral line (removed during the Site 1 soil removal) previously entered the West Ditch from the east. Manhole 140 also marks the location along the West Ditch where a badly deteriorated portion of the CMP was replaced to the south in 1997, and where the original CMP is still in place to the north.

Flow measurements conducted at the West Ditch headwall and in Manhole 140 by the USGS (Section 4.1.1) indicate that approximately 1 to 5 gpm of water enters the CMP between these two points. The USGS indicates that these measurements are always taken at least several days after storm events to be sure that only groundwater infiltration is being measured and possible impacts from stormwater runoff are eliminated. The water within the CMP ultimately daylights approximately 420 feet south of the headwall, where it flows overland for a short distance before entering a former oil/water separator (**Figures 5** and **6**). The water then exits the separator and again flows underground through an approximate 20-foot section of steel pipe before draining into the Navy Line at Outfall 1.

4.2 SUMMARY OF PREVIOUS STORM SEWER ENVIRONMENTAL INVESTIGATIONS

Elevated VOC concentrations in the NAWC storm water were first identified by the Navy during an RI conducted in the early 1990s (IT Corporation, 1994). That RI and subsequent investigations led to the discovery and delineation of a groundwater plume originating at NAWC Trenton that contained elevated concentrations of VOCs. The Navy is actively remediating this groundwater plume through the use of 12 extraction wells and a pump and treat groundwater remediation system. The effectiveness of the remediation is tracked and evaluated through the annual sampling and reporting of contaminant concentrations in 72 monitoring wells and the quarterly sampling and reporting of contaminant concentrations in 7 extraction wells and 8 surface water locations, including Gold Run and the 4 storm sewer outfalls.

The NJDEP, in its review of the Summary Report for the Winter (February) 2010 Quarterly Sampling Event (NJDEP, May 24, 2010) (see **Appendix A**) recognized that the Navy has taken various actions to stop the continued discharge of contaminated groundwater to the storm sewers and to Gold Run, but commented that by allowing continued discharge, the Navy had failed to meet the applicable standards as required by New Jersey Administrative Code (N.J.A.C.) 7:26E-1.3(c), specifically, the Minimum Surface Water Remediation Standards identified in N.J.A.C. 7:26D-3. It was also in this letter (see Section 4.1) that the NJDEP required that subsequent to the submittal of an RAR, the Navy must submit either a Remedial Action Selection Report to identify the technology that would be used to remediate the infiltration problem, or a Remedial Action Work Plan for additional site investigation that would be used to acquire any additional data that would be needed to evaluate and select the best available technology. This SAP and the associated Health and Safety Plan (HASP) shall serve as the Remedial Action Work Plan.

The storm water infiltration issue and discharge to Gold Run is discussed in detail in the Remedial Action Report – Evaluation of Groundwater Infiltration to Gold Run Creek (Tetra Tech, 2010). This report thoroughly summarizes and evaluates the effectiveness of the Navy's multiple efforts to date to identify, isolate, and eliminate the discharge of contaminated groundwater to the storm sewers and to Gold Run, most notably by replacing an approximately 160-foot long section of deteriorated CMP within the Outfall 1 storm sewer (also known as the West Ditch) between Manhole 140 and the former oil-water separator (see **Figure 6**). The RAR also noted, however, that (as concluded by the NJDEP) none of the attempted remedies had been completely effective.

The RAR concluded that multiple lines of converging evidence indicated that by far, the bulk of the VOCs detected in the Navy drain line beneath Parkway Avenue were entering the storm water system through the infiltration of contaminated groundwater into the upper (northern) segment of the West Ditch CMP that had not been replaced, between Manhole 140 and the headwall of the storm sewer line. Although the available data are limited, the preliminary results from the current USGS investigation indicate that up to 1,200 micrograms per liter (µg/L) of VOCs (trichloroethene [TCE], cis-1,2-dichloroethene [1,2-DCE], and vinyl chloride [VC]) enters the CMP with the infiltrating groundwater through this upper stretch, although total concentrations of about 200 µg/L appear to be more typical. The invert elevation of the CMP along this stretch is not known, but the monitoring of MW-1S by the USGS (Section 4.2.1) indicates that the groundwater elevation within the overburden along this stretch may always be above the invert elevation, and is certainly above the invert elevation after periods of significant precipitation.

Since the submittal of the RAR, additional quarterly monitoring data recently collected by the Navy in March 2011 (see **Appendix A**) has indicated that additional VOCs may also be infiltrating the West Ditch (Outfall 1) sewer system in the approximately 30-foot long stretch of original pipe between the on-base former oil-water separator and the connection of the Outfall 1 sewer to the Navy drain line beneath Parkway Avenue. These data are summarized on **Figure 7**, and represent periods when the extraction system was operating (November 2010) and not operating (March 2011). Although the evidence is indirect, the absolute and relative changes in the site's primary TCE, cis-1,2-DCE, and VC concentrations indicate that the water discharging from the former separator is chemically dissimilar to the water discharging into the Navy line. Specifically, the water discharging into the Navy line contains about the same or lower concentrations of TCE, but higher concentrations of cis-1,2-DCE and VC. Although also limited, the analytical results for the overburden groundwater in this area (MW-40S and MW-41S; **Figure 6**) indicate that the local groundwater is relatively low in TCE but high in cis-1,2-DCE and VC, which leads to the conclusion that this groundwater is infiltrating the West Ditch pipe prior to the water discharging at Outfall 1. Historically, water has been observed discharging from the separator while Outfall 1 was dry, indicating a likely breach in that section of pipe, with water exfiltrating due to the water table falling below the invert elevation of the pipe; it is equally possible that water infiltrates the pipe when the groundwater elevation within the overburden is above the invert elevation of the pipe. Recent conversations between the Navy and the USGS have confirmed this hypothesis, as groundwater was observed discharging into the pipe.

The RAR also concluded that an additional, though significantly lesser, volume of VOCs was discharging into the Navy Line via the Outfall 2 sewer system.

4.3 SOIL AND GROUNDWATER CONTAMINATION AND REMEDIATION

The Navy RI included soil, groundwater, surface water, and sediment sampling to determine the nature and extent of COCs. The RI reported that chlorinated VOCs, in particular TCE and its degradation products 1,2-DCE and VC, were the primary COCs in soil and groundwater, with the highest levels of contamination occurring at Site 1.

The Navy conducted a soil removal action in 1998 through 1999 that removed the Site 1 soil contaminated to concentrations of 1 milligram per kilogram (mg/kg) (1 part per million) and higher. Approximately 15,500 cubic yards of soil were removed from the southwestern portion of the site. The limits of the excavation are illustrated on **Figure 6**.

Groundwater remediation at NAWC Trenton began in 1995 with the construction of a groundwater treatment plant and the extraction of groundwater from a single well (MW-15BR). Subsequent groundwater monitoring, site characterization, and modeling studies (primarily by the USGS) have led to the expansion and refinement of the groundwater extraction system to assure that the groundwater plume located within the bedrock is captured and treated on site, and does not migrate off-site. The groundwater treatment plant was upgraded in 1997 to a capacity of 60 gpm. Currently, 12 extraction wells are utilized. The treated groundwater is discharged under a National Pollutant Discharge Elimination System (NPDES) permit to the Navy-dedicated storm drain located adjacent to Parkway Avenue that eventually flows into Gold Run.

Overburden wells within the vicinity of the Brine Handling Area and West Ditch are typically dry. However, several have been found to contain significant concentrations of VOCs when the overburden is sufficiently saturated and the wells are sampled (**Figures 6** and **8**). The source of these VOCs is not definitively known; it may be precipitation water that has migrated through contaminated soil, or contaminated bedrock groundwater that has migrated upward with the rising water table from the weathered bedrock, or both.

4.4 CONCEPTUAL SITE MODEL

Spills and releases from general site activities at the former NAWC Trenton are sources of groundwater VOCs contamination. Analytical results from previous site investigations have shown that historical operations at the site have resulted in releases of VOCs directly into site soils and underlying groundwater, floor drains, and stormwater catch basins. Site soil is relatively permeable, which permits contaminants in the soil to move into groundwater. Contaminants dissolved in groundwater flow with the groundwater, although not as rapidly as the groundwater because of chemical interactions between the contaminants and the soil or bedrock through which the groundwater flows. Contaminants in the groundwater present a potential human health risk if the groundwater would be contacted, or ingested, or the contaminants (especially the more volatile VOCs) would be inhaled as they evaporate from the water. The federal Maximum Contaminant Levels (MCLs) and NJDEP Groundwater Quality Standards (GWQSs) are contaminant concentration limits above which the human health risk could be unacceptable.

Historically, TCE and other organics and inorganics present in spilled materials or sludge migrated into the overburden and eventually the underlying fractured bedrock. Groundwater beneath the site generally flows towards the south-southeast; however, local flow direction depends upon available pathways (i.e., bedding plane partings and vertical fractures) within the fractured bedrock aquifer. TCE, 1,2-DCE, and VC were reported at concentrations greater then MCL and GWQS criteria in samples collected from overburden and bedrock monitoring wells within Site 1. During the RI, the maximum concentrations of VOCs detected in overburden and bedrock monitoring wells were 5,300 µg/L of 1,2-DCE and 750,000 µg/L of TCE.

Figures 8 and **9** illustrate 2007 overburden and bedrock concentrations of TCE, cis-1,2-DCE, trans-1,2-DCE, tetrachloroethene (PCE), VC, and 1,1-DCE that exceeded current New Jersey GWQS. The specific GWQS for each contaminant is also shown. Within the underlying fractured bedrock, the highest TCE concentrations are found within the Site 1 area, with the maximum concentration of 106,000 µg/L at well 36BR. The highest observed VC concentration in a bedrock groundwater sample was 2,440 µg/L in well MW-07BR, and the highest observed cis-1,2-DCE concentration of 17,800 µg/L was detected in a sample from well MW-30BR.

In March 2011, the Navy completed the most recent sampling round for extraction wells, selected overburden monitoring wells, and surface water (storm sewer locations), during a period when the groundwater extraction system had not been operating for several months (see **Appendix A**). The most recent VOC concentrations detected in the extraction and monitoring wells is illustrated on **Figure 6**, and the most recent VOC concentrations detected at the Navy outfalls and in the off-site sewers are illustrated on **Figure 7**.

The analytical results from historical and recent sampling events of overburden monitoring wells and surface water locations and the preliminary results of the ongoing West Ditch study being conducted by the USGS were used to construct a Conceptual Site Model (CSM) illustrating the source of the VOCs and their migration pathways into the Parkway Avenue sewer system. This model is illustrated on **Figure 10**, and is discussed in the following paragraphs.

The primary source of VOCs discharging into the Parkway Avenue sewer system is the contaminated overburden groundwater that infiltrates the West Ditch (Outfall 1 system) 36-inch CMP along the stretch between its headwall and Manhole 140. This infiltrating water may be precipitation water that has migrated only through contaminated soils and then laterally into the pipe, or contaminated groundwater that is discharging upward from the bedrock and either directly through the bottom of the pipe or into the soils and then into the pipe, or any combination of these scenarios. For the first scenario, the nature and extent of contamination are not known within the soils that were not removed as part of the Site 1 remedial action, particularly the soils within the immediate vicinity of the West Ditch. The documentation of the soil remediation indicates that the remediation goal for TCE was 1 mg/kg. Therefore, it is possible that soils containing TCE at concentrations near 1 mg/kg still remain on site, even in the vicinity of the soil remediation.

Stormwater also enters the West Ditch through a lateral line draining the runoff between Building 41 and Building 42 (see **Figure 6**). Although limited, the existing data indicate that this lateral line is not a major contributor of VOCs to the West Ditch drainage line. This line was repaired with cured-in-place pipe (CIPP) in 1993. According to the Navy, previous attempts at sampling this lateral line at Port 001 have not been successful because the line often is dry. However, a sample was recently obtained (March 2011, **Appendix A**) and contained very low levels of two VOCs, including TCE at 2.9 µg/L and cis-1,2-DCE at 1.2 µg/L. This TCE value slightly exceeds the GWQS of 1 µg/L, but the cis-1,2-DCE value does not exceed the GWQS of 70 µg/L. Therefore, this lateral line does not appear to be a major source of the VOCs detected in the West Ditch.

Stormwater also enters the West Ditch through a roof drain from the west side of Building 41 (see **Figure 6**). Although stormwater draining from the roof is not expected to contain significant concentrations of VOCs, it is possible that overburden groundwater that does contain VOCs could be infiltrating the buried segment of the drainline between the downspout and the West Ditch. It is not currently possible to test this hypothesis because there are no sampling ports along this line.

In summary, approximately 1 to 5 gpm of groundwater infiltrates the West Ditch CMP between its headwall and Manhole 140, resulting in a total VOC concentration of about 200 ug/L at Manhole 140. Because of the dilution resulting from its mixing with uncontaminated water, it is likely that the VOC concentrations of the infiltrating water are greater than the total concentration measured at Manhole 140. The spring water entering the headwall does not contain VOCs, and the water entering from the surface water lateral line (as measured at Port 001) contains very low levels of VOCs. Therefore, the Navy has concluded that the VOCs are entering the West Ditch either through the roof drain lateral line, or through deteriorated sections of the CMP, or both. The poor quality of the lower stretch of CMP that was replaced in 1997 was an indication that the upper stretch (north of Manhole 140) may be in similarly poor condition. This indication was recently confirmed by a video survey inspection (see **Appendix A**). The spatial distributions of VOCs in soil and shallow groundwater along the West Ditch are also not completely defined, so the infiltration points of the contaminated water into the CMP are not known (that is, some of the water that was infiltrating into the CMP may not necessarily be contaminated).

The groundwater VOC concentrations measured at the West Ditch outfall of the CMP to the oil/water separator are similar to the concentrations measured at Manhole 140. However, VOC concentrations measured at the West Ditch outfall to the Navy Line sewer beneath Parkway Avenue are significantly different than the concentrations entering and exiting the separator. Much greater concentrations of cis-1,2-DCE and VC are typically measured within the Navy Line, suggesting that groundwater containing high levels of these VOCs are infiltrating the 20-foot stretch of steel pipe between the former separator and the Navy Line. Analyses of groundwater samples taken from overburden monitoring wells in this vicinity confirm that the shallow groundwater contains high levels of cis-1,2-DCE and VC. The quality of the steel pipe is not known, but will be investigated by the Navy during an upcoming video survey.

The Navy currently operates and monitors a groundwater pump-and-treat system that recovers contaminated groundwater from the underlying fractured bedrock and hydraulically contains water within or immediately adjacent to the site boundaries. Recovered groundwater is currently being extracted via nine wells (MW-08BR, MW-15BR, MW-20BR, MW-29BR, MW-45BR, MW-48BR, MW-22BR, MW-56BR, and the West Ditch Well [WDW]). Other extraction wells are also in place if monitoring indicates additional groundwater extraction is necessary for plume capture. The degree to which these wells are containing the groundwater flow within the overburden is not known. Lowering the hydraulic head within the bedrock should create a downward hydraulic gradient and induce the overburden groundwater to flow downward into the bedrock, but according to qualitative observations reported by the USGS, the degree of hydraulic communication between the overburden and the bedrock appears to be relatively low. However, the storm sewer sampling event conducted in November 2010 suggests that some overburden groundwater may be migrating off-site. During this event, Outfall 1 was dry, but water containing site-related VOC COCs was recovered from the upgradient (Township) location of Outfall 2, before any water draining from a NAWC Trenton outfall had entered the line.

4.5 CURRENT LAND OWNERSHIP

Following operational closure of NAWC Trenton in 1998, the facility was subdivided into four parcels (See **Figure 1**). Parcel A is about 28 acres and encompasses a portion of the Trenton-Mercer Airport which is owned and operated by the County of Mercer Airport Administration. Nineteen monitoring wells that are included in the LTM program are located on this parcel. Parcel B is about 27 acres and is owned by N&H Mercer Realty/Nassimi Realty, a local development company that has plans for future long-term commercial use of the site. The primary source areas for the groundwater contamination are located within this parcel and the Navy has installed numerous overburden and bedrock extraction and monitoring wells for capture and containment of impacted groundwater. The groundwater treatment plant is located in the southwest corner of Parcel B. Parcel C as shown on **Figure 1** is a 9.5-acre parcel located on the southeast corner of the former NAWC facility. It is owned by 1400 Parkway LLC for expected future commercial and residential development. Parcel D is approximately 1 acre in size and is owned by the Township of Ewing, New Jersey. At this time, there are no long-term development plans for this parcel.

5.0 -- Data Quality Objectives/Systematic Planning Process Statements

(UFP-QAPP Manual Section 2.6.1 – Worksheet #11)

The following text describes the development of Data Quality Objectives (DQOs) using USEPA's DQO Systematic Planning Process (USEPA, 2006a).

5.1 PROBLEM STATEMENT

Discharge of contaminated groundwater to the Navy dedicated line of the Parkway Avenue sewer system was first identified and reported in 1992. Multiple attempts to eliminate this discharge have been partially successful to unsuccessful (Tetra Tech, 2010). The NJDEP has required the Navy to eliminate this discharge, and to perform any additional field work that is necessary to fully evaluate the potentially effective remedial alternatives. The work included in this SAP is designed to acquire the additional data needed for evaluation of alternatives. To achieve this:

- Soil data are also needed to determine whether residual VOCs and metals in the soil of the planned excavation area are a source of groundwater contamination discharging to the sewer system, and if so, determine their location;

- Soil data are needed to determine whether soils to be excavated during the rehabilitation of the West Ditch Area CMP must be disposed as hazardous waste; and

- Groundwater and surface water data are needed to:
  - Identify changes, if any, in the overburden groundwater flow regime or to the nature and extent of VOCs and metals contamination in the overburden caused by repair of the CMP.
  - Identify areas of infiltration of contaminated groundwater into the surface water conveyance system by assessing the quality of the groundwater flowing into the backfilled trench after the West Ditch CMP replacement.
  - Evaluate overall changes in the quality of stormwater discharging from the former NAWC Trenton facility (at outfall GR-OF).

Specific activities that must be included in this investigation per agreement with NJDEP are described on **Worksheet #3**.

5.2 INFORMATION INPUTS

Data that are required to resolve the problem described in Section 5.1 are as follows:

1. Chemical data: Soil total concentrations for VOCs and metals are needed to evaluate the soil as a potential source of COCs in the West Ditch Area. If any of the total concentrations for a VOC indicates a possibility to exceed a Toxicity Characteristic Leaching Procedure (TCLP) regulatory limit for hazardous waste, assuming a maximum leaching of 100 percent of the soil concentration into the TCLP leachate, soil TCLP leachate concentrations are needed to classify waste soil that will be disposed from the excavation of soil as part of the remedial action. Groundwater and surface water concentrations for VOCs are needed to support a determination of the nature and extent of contamination from COCs in groundwater and surface water and, especially, the likely source(s) and location(s) of infiltration from the groundwater into the surface water in the West Ditch Area. These data will be obtained from analysis of samples of groundwater collected from the populations described in Section 5.3. Field screening with a photoionization detector (PID) is required to facilitate identification of the most contaminated soil depths (See Section 5.3).

2. Physical data: Field investigation parameters for surface water and groundwater of pH, specific conductance, turbidity, temperature, oxidation-reduction potential (ORP), and dissolved oxygen (DO) must be collected in the field to ensure the representativeness of surface water and groundwater samples collected and to assist with site characterization. Contaminated soil volumes must be computed by visually estimating the later extent of contamination (with the help of a planimeter) and multiplying this area by the estimated depth of contamination.

3. Groundwater level measurements: Water level measurements to provide information regarding the lateral distribution of hydraulic head and the elevation of the water table, to determine the degree of saturation within the overburden and to determine the direction(s) of groundwater flow within the overburden, including the West Ditch backfill. Installation of piezometers is sufficient to provide these data.

4. Surface water level measurements: Water level measurements to provide information regarding depths to surface water to assess the potential for infiltration into the sewer conveyance system from the local groundwater table.

5. Sample location data: Sample location horizontal coordinates and vertical depths must be measured. Horizontal coordinates will be measured using a global positioning system (GPS). These coordinates must be documented in the datums identified in **Worksheet #8.0**, “Global Position System Locating” section.

6. Project Action Limits: Project action limits (PALs) are necessary to evaluate soil, groundwater, and surface water data. PALs for the VOCs and metals COCs in soil are the NJDEP Residential Direct Contact Soil Remediation Standards (RDCSRS) (totals) and the PALs for soil leachate, if necessary, will be the TCLP VOCs and metals regulatory limits. PALs for the VOCs COCs in groundwater are the NJDEP GWQS from N.J.A.C 7:9C (http://www.state.nj.us/dep/wms/bwqsa/gwqs.htm). PALs for the VOCs COCs in surface water are the NJDEP Surface Water Quality Standards (SWQS) from N.J.A.C. 7:9B (http://www.state.nj.us/dep/wms/bwqsa/swqs.htm).

To conduct comparisons of site data to PALs, the selected laboratory must be able to achieve Limits of Quantitation (LOQs) that are low enough to measure constituent concentrations less than the PALs. Analytical data reported by the laboratory use the following reporting conventions: All concentrations less than the Detection Limit (DL) will be considered non-detects and will be reported as the limit of detection (LOD) value with a "U" qualifier; and concentrations between the DL and LOQ will be reported as estimated values with a “J” qualifier. In the event that a target analyte has a PAL between the LOD and LOQ, the “J” flagged data will be accepted to achieve project goals. The inability to quantify select analytes to PALs with confidence will be addressed in the final report.

The complete list of applicable soil, soil leachate, groundwater, and surface water PALs are presented in **Worksheet #9.0** and are identified to ensure laboratory sensitivity is sufficient to meet project goals.

5.3 STUDY AREA BOUNDARIES

Soil of interest is the soil that lies in the immediate vicinity of the West Ditch, in an approximately 10-foot-wide corridor centered along the 36-inch CMP, and stretching from the current headwall to the north to Outfall 1 to the south. The vertical boundaries are the ground surface downward to the top of weathered bedrock. This soil is of interest because it is the most likely candidate to be the (or a) source of the VOCs contamination that is infiltrating the West Ditch in the aqueous phase and ultimately discharging to the Parkway Avenue sewer system. Soils outside of this corridor are beyond the scope of this investigation. It is especially important to identify and characterize the most contaminated soil in this area because that is the soil that holds the greatest potential for contaminating groundwater.

Groundwater of interest is overburden groundwater throughout Site 1 (especially in the immediate vicinity of the West Ditch), because this is the groundwater that is infiltrating into the West Ditch CMP and therefore may be contaminating the water in the sewers. Groundwater associated with existing overburden wells and new piezometers to be installed during the remediation of the 36-inch CMP must be sampled to assess the post-construction quality of this groundwater and to assess if the construction has changed the containment or migration patterns of the VOCs. **Figure 6** shows the locations of all existing overburden monitoring wells and potential locations for the future piezometers. The vertical boundaries are the extent of groundwater saturation in the overburden zone, or from the water table downward to the top of bedrock.

Surface waters of interest are all surface waters starting at the West Ditch spring, ending at the outfall of the Navy dedicated Parkway Avenue sewer line to Gold Run, and all intervening surface waters in the Navy Line and West Ditch sewer lines. At each of the four on-site manholes (outfall locations), two distinct surface water stream segments are represented at each outfall location. Data collected from the outfall discharge pipe (designated as "N") is representative of Navy site or facility groundwater and surface water runoff that infiltrates the storm sewer system. Data collected from the upstream discharge in the off-site stormwater line from the Township discharge (designated as "T") is representative of the upstream surface water; however, as it flows by the facility, it commingles with the flow from the Navy discharge individual outfall "N" piping. These data represent VOC concentrations in the off-site line and in the outfall discharge, and also indicate whether all of the contaminated groundwater is being contained on-site, or potentially migrating directly into the Parkway Avenue line.

Temporal boundaries – Seasonal variations in groundwater and/or surface water levels, flows, and concentrations must be investigated by collecting quarterly samples from the West Ditch Area for a period of one year following completion of the remedial design and by evaluating these variations in the Groundwater Infiltration Investigation Report.

5.4 ANALYTIC APPROACH

Soil data will be collected by Tetra Tech to support the remedial design decision, which is not within the scope of this SAP. Quarterly piezometer data will be monitored by the O&M Contractor for groundwater levels and VOC concentrations for a period of four quarters after the remedial design has been implemented. Historical (to current) LTM monitoring well data from the West Ditch Area will be obtained from the O&M Contractor and reviewed to determine the most likely source(s) of infiltration from groundwater into the surface water in the West Ditch Area. Quarterly monitoring well data from the West Ditch Area will be obtained from the O&M Contractor for a period of four quarters after the remedial design has been implemented and reviewed to identify any significant changes to COC concentrations in relation to historical results. Quarterly surface water data will be monitored by the O&M Contractor for VOC concentrations for a period of four quarters after the remedial design has been implemented and will be reviewed by the Navy to identify any significant changes to COC concentrations in relation to historical results.

VOCs and total metals concentration data from the sampling events will be compared to the matrix-specific PALs presented in **Worksheet #9.0**. The VOCs and metals data collected will be used to make project decisions using the following decision rules:

Decision #1: If all measured soil concentrations for VOCs and total metals are less than the respective soil PALs, then conclude that the soil is not a continuing source of these COCs into groundwater in the West Ditch Area; otherwise, identify each PAL exceedance in the Groundwater Infiltration Investigation Report as a source of COCs migrating from the soil into the underlying groundwater in the West Ditch Area.

Decision #2: If all measured soil concentrations for TCLP VOCs and TCLP metals (limited to those soil samples that exhibit total concentrations of COCs that have the potential to exceed the TCLP criteria and limited to the project-specific COCs) are less than the respective soil TCLP leachate PALs, then recommend that the soil excavated in the associated area be disposed as non-hazardous with respect to VOCs and metals toxicity; otherwise, estimate the extent of soil VOC or metal concentrations that exceeds their TCLP regulatory limits and compute the quantity and location(s) of soil that must be excavated and disposed separately as hazardous waste.

Decision #3: Based on quarterly piezometer data, if any groundwater level in the West Ditch Area exceeds the historical range after the remedial design has been implemented, then conclude that the CMP leaks had previously depressed local groundwater levels and that the CMP repairs have influenced the local hydrogeological regime; otherwise, conclude that there has been no significant change to water levels in the West Ditch Area.

Decision #4: If any measured groundwater VOC COC concentrations in any sample is greater than or less than the historical range of LTM data after the remedial design has been implemented, conclude that the remedial action has altered the hydraulic nature of the West Ditch Area and that additional data or further investigation may be required to delineate the new migration pathway(s) for the VOCs in the overburden groundwater; otherwise, conclude that the remedial action has not significantly altered the nature and extent or fate and transport characteristics of the overburden groundwater.

Decision #5: If any measured surface water VOC COC concentration exceeds its PAL after the remedial design has been implemented, then conclude that CMP repairs did not halt the flow of contaminated water into the sewer conveyance system and develop a plan to determine where the surface water impact begins and how it is entering the sewers, based on the analytical results; otherwise, conclude that CMP repairs reduced the impact to surface water in the West Ditch Area to acceptable levels.

5.5 PERFORMANCE OR ACCEPTANCE CRITERIA

Simple comparisons of measured concentrations to PALs are required in this investigation. The Project Team will use the measured results to determine whether the amount and type of data collected are sufficient to support the attainment of project objectives. This will involve an evaluation of contaminant concentrations and an evaluation of uncertainty for contaminants that have action levels less than the laboratory DLs to ensure that contaminants are likely to have been detected, if present.

If all data have been collected as planned and no data points are missing or rejected for quality reasons, the data completeness will be considered satisfactory. If any data gaps are identified, including missing or rejected data, the Project Team will assess whether a claim of having obtained project objectives is reasonable. This assessment will depend on the number and type of identified data gaps; therefore, a more detailed strategy cannot be presented. All stakeholders will be involved in rendering the final conclusion regarding adequacy of the data.

5.6 SAMPLING DESIGN AND RATIONALE

The plan for obtaining data along with the sampling designs and rationales are described in detail in **Worksheets #7.0** and **#8.5**.

6.0 -- Field Quality Control Samples

(UFP-QAPP Manual Section 2.6.2 – Worksheet #12)

Quality Control (QC) Sample	Analytical Group	Frequency	Data Quality Indicators (DQIs)	Measurement Performance Criteria (MPCs)	QC Sample Assesses Error for Sampling (S), Analytical (A) or Both (S&A)
Equipment Rinsate Blank	All analytical groups	One per 20 samples per matrix per sampling equipment[1]	Bias/ Contamination	No analytes ≥ ½ LOQ, except common laboratory contaminants, which must be < LOQ.	S & A
Trip Blank	VOCs only	One per cooler containing VOC samples.	Bias/ Contamination	No analytes ≥ ½ LOQ.	S & A
Field Duplicate	All analytical groups	One per 10 field samples	Precision	Values > 5X LOQ: Relative Percent Difference (RPD) must be ≤30 (aqueous)[2],[3] ; ≤50 (solids)[2],[3].	S & A
Cooler Temperature Indicator	All analytical groups	One per cooler	Representativeness	Temperature must be above freezing and less than or equal to 6 degrees Celsius (°C).	S

Notes:

1 Equipment rinsate blanks will be collected if non-dedicated submersible pumps or other equipment are used.
2 If duplicate values for non-metals are less than five times the LOQ, the absolute difference should be less than or equal to two times the LOQ.
3 If duplicate values for metals are less than five times the LOQ, the absolute difference should be less than or equal to four times the LOQ.

7.0 -- Sampling Design and Rationale

(UFP-QAPP Manual Section 3.1.1 – Worksheet #17)

7.1 SOIL SAMPLING DESIGN AND RATIONALE

This SAP identifies tasks that will be performed by Tetra Tech, as well as ongoing LTM tasks and sampling events that either have been or will be performed separately by the Navy's on-site O&M Contractor, Watermark. The LTM SAP provided by Watermark to the Navy, USEPA, and NJDEP may be modified or incorporated by reference for the approval of project-related tasks (i.e., piezometer installation and/or sampling and analytical data, etc.) that will be conducted by Watermark which are not already covered under the NAWC Trenton LTM SAP. The soil sampling design is based on placing monitoring points where the Project Team believes they have the greatest potential for providing information needed to render the decisions of Section 5.4 with a minimum number of data collection points.

7.2 GROUNDWATER SAMPLING DESIGN AND RATIONALE

A biased sampling approach was selected for investigation of groundwater intrusion into surface water at NAWC Trenton based on years of various historical investigations and LTM data. **Worksheet #8.5** presents the sampling locations for each groundwater sample, including the rationale for inclusion of each groundwater sample, and the frequency of sampling. A total of five existing monitoring wells in the West Ditch Area are included in this SAP, and an anticipated 4 to 10 future piezometers that will be installed in the West Ditch Area after the remedial design is completed are included in this SAP. The sampling is expected to be quarterly for one year to identify any seasonal variations, but will be determined by future discussions with NJDEP.

Figure 6 presents a map of the monitoring well network and the outfalls and storm drains for surface water sampling. **Appendix A** provides a full-size map of the well locations and the storm sewer outfall locations. Detailed maps and cross-sections showing monitoring well locations can be found in the following reports: Hydrogeologic Framework, Water Levels and Trichloroethylene Contamination (USGS, 2000) and Ground-Water Levels and Potentiometric Surfaces (USGS, 2002).

7.3 SURFACE WATER SAMPLING DESIGN AND RATIONALE

Surface water samples will be collected from the stormwater system outfalls in order to assess the impact of discharged groundwater on surface runoff and the impact of the spring water to the surface water quality and flow/volume. **Worksheet #8.5** presents the biased sampling locations for each surface water sample, including the rationale for inclusion of each surface water sample, and the frequency of sampling. A total of 14 existing surface water locations in the West Ditch Area are included in this SAP. The sampling is expected to be quarterly for one year to identify any seasonal variations, but will be determined by future discussions with NJDEP.

8.0 -- Field Project Implementation (Field Project Instructions)

(UFP-QAPP Manual Section 5.2.3 – Worksheets #14, 18, 19, 20, 21, and 30)

8.1 PROJECT AND FIELD OBJECTIVES

The objective of the field work is to obtain the soil and groundwater data that are needed to meet the project objectives. Soil analytical data will be used to evaluate whether the source of the groundwater contamination that is infiltrating surface water is in the immediate vicinity of the West Ditch and to determine the waste characteristics of the soil, if excavation and off-site disposal is required. The groundwater data will be used to determine the location(s) of the contaminated groundwater that is infiltrating the sewer, and will be used to determine whether the subsequent remediation of the sewer changes the nature and extent or the fate and transport characteristics of the overburden groundwater. Project objectives are described in more detail in Section 5.1.

The timeline for major project tasks are anticipated to include the following:

- Video survey by O&M Contractor – Summer 2011.
- Soil borings by Tetra Tech – Fall 2011.
- CMP Remediation by a Construction Contractor, including piezometer installation in backfill – Summer 2013.
- Quarterly piezometer, monitoring well, and surface water sampling for one year by O&M Contractor – Summer 2013 to Spring 2014.

8.2 FIELD PROJECT TASKS

(UFP-QAPP Manual Section 2.8.1 – Worksheet #14)

Project-specific Standard Operating Procedures (SOPs) and Field Forms for field tasks referenced in this worksheet are identified by title in **Worksheet #8.4**. Copies of Tetra Tech Field Forms are provided in **Appendix B**. The project field tasks are as follows:

- Mobilization/Demobilization
- Site-Specific Health and Safety Training
- Site Access
- Utility Clearance
- Monitoring Equipment Calibration
- General Sample Collection and Sample Handling Tasks
- Soil Boring Field Screening
- Soil Sampling
- Piezometer Installation and Development

- Groundwater Level Measurements
- Groundwater Sampling
- Surface Water Sampling
- Global Positioning System Locating
- Investigation-Derived Waste Management
- Field Decontamination Procedures
- Field Documentation Procedures
- Quality Control Tasks

Mobilization/Demobilization

Mobilization shall consist of the delivery of all equipment, materials, and supplies to the site, the complete assembly in satisfactory working order of all such equipment at the site, and the satisfactory storage at the site of all such materials and supplies. The O&M Contractor FOL or designee will coordinate with the Navy RPM to identify locations for the storage of equipment and supplies. Site-specific Health and Safety Training for all field personnel will be provided as part of the site mobilization.

Demobilization shall consist of the prompt and timely removal of all equipment, materials, and supplies from the site following completion of the work. Demobilization includes the cleanup and removal of IDW generated during the investigation.

Site-Specific Health and Safety Training

Each site worker performing sampling of hazardous materials will be required to have completed appropriate Hazardous Waste Operations and Emergency Response (HAZWOPER) training specified in Occupational Safety and Health Administration (OSHA) 29 Code of Federal Regulations (CFR) 1910.120(e). Safety requirements are addressed in greater detail in the site-specific HASP.

Site Access

The Tetra Tech FOL or designee will coordinate site access for field activities performed by Tetra Tech and the O&M Contractor FOL or designee will coordinate site access for field activities performed by the O&M Contractor. At this time, it is anticipated that all of the wells to be sampled for this investigation are located on the former Site 1 NAWC Trenton property.

Utility Clearance

One week prior to the commencement of any intrusive activities, Tetra Tech will coordinate with the Navy RPM to identify and mark-out utilities that may be present within the proposed soil boring and excavation areas. Subsurface utilities will also be cleared by the excavation subcontractor by notifying the New Jersey One-Call utility clearing service. See the NJDEP Field Sampling Procedures Manual (FSPM) (NJDEP, 2005) for further details on utility clearance.

Monitoring Equipment Calibration

Field equipment will be calibrated by the Tetra Tech FOL or designee in accordance with the FSPM and with the manufacturer's guidance. Documentation of the field equipment calibration is required in accordance with FSPM Sections 6.2.4 and 6.9.2.2.5.8. Field equipment should be calibrated at the beginning and end of each day, unless otherwise stated by the equipment manufacturer.

General Sample Collection and Sample Handling Tasks

The sampling and analysis program is outlined in **Worksheets #7.0** and **#8.5**. Sample labeling, sample numbering, methods for recording field data, and the selection of sample containers, sample preservation, packaging, and shipping will be in accordance with the FSPM. References to specific sections of the FSPM for specific tasks are identified in **Worksheet #8.4**.

Sample containers will be provided certified-clean (I-Chem 300 or equivalent) from the analytical laboratory. The selection of sample containers, sample preservation, packaging, and shipping will be in accordance with **Worksheet #8.6**. Field and laboratory QC samples will also be collected as outlined in **Worksheet #8.7**.

Soil Boring Field Screening

To maximize the efficiency and cost/effectiveness of soil sampling from soil borings, field screening will be used to identify contaminated soil and semi-quantitatively assess the magnitude of contamination using a PID to identify the presence of VOCs in soil cores.

PID – A PID will be used to continuously scan all soils from core samples to obtain a qualitative approximation as to whether a soil may be contaminated with VOCs. A PID has been selected to perform this task rather than a flame ionization detector (FID) because the FID is sensitive to methane, which is being produced in varying (but potentially large) quantities by currently operating bioremediation pilot tests. PID screening will be completed in accordance with FSPM Section 6.2.6.

Soil Sampling

Under the direction of Tetra Tech, a maximum of eight soil borings will be advanced using hollow-stem auger (HSA) and split-spoon sampling technology at locations specified in **Worksheets #7.0** and **#8.5** and associated figures. If access to a proposed soil boring location is obstructed or if other circumstances warrant a small change in borehole location, boring locations may be moved up to 25 feet in any direction (at the discretion of the Tetra Tech FOL), based on site conditions, without approval from the Navy. Any relocation beyond this specification requires Navy approval. All new soil boring locations must be cleared of utilities before beginning the intrusive activities at those locations.

Borings will be advanced to the top of bedrock, which will be defined in the field as split-spoon refusal. The depth to the top of bedrock is variable and difficult to predict at any particular location, but generally ranges from about 20 feet bgs in the northern part of Site 1 to about 6 feet bgs in the southern part.

HSA drilling will be performed in accordance with procedures outlined in FSPM Sections 5.3 and 6.1. With an HAS rig, an auger is advanced by rotation and the drill cuttings are brought to the surface by travelling up the outside of the auger flights, which are typically 5 feet long. Soil samples are obtained by driving a split-spoon sampler inside the hollow stem and advancing it into the undisturbed soil below the bottom of the deepest auger. Split-spoon sampling techniques are discussed in FSPM Section 5.3.1.4. An HSA borehole is kept open by the auger flights, so collapsing borehole conditions are not of concern. Conventional HSA drilling rigs can easily drill to the planned maximum depths of this investigation.

All soil borings will be drilled in the immediate vicinity of the West Ditch. Based on previous site reconnaissance, it is anticipated that all boring locations that will be drilled are topped by dirt or grass. If asphalt or concrete cover exists at a borehole location, the cover will be cleared from the location prior to advancing the boring. The surface at each boring location will be restored to its pre-existing condition upon completion of the boring.

As each soil core interval is removed from a borehole, the split-spoon containing the core will be opened. The lithology of the cored interval will be described by the Tetra Tech Site Geologist using the Unified Soil Classification System (USCS) in accordance with FSPM Section 6.2.3.2, and the length of every core will be continuously scanned for VOCs using a PID and for any qualitative visual signs of contamination such as a sheen or staining. Institutional controls will be employed to minimize the effects of the wind on the PID readings, such as taking the readings on the lee side of the field vehicle. The PID probe will be passed slowly over the core to assure that no hot spots are missed, and the core surface will be disturbed with a trowel at approximately 6-inch intervals to expose additional material.

VOCs – Two samples from each boring will be selected for fixed-base laboratory analysis for VOCs. The selection of the samples will be according to the following procedure:

- Subsurface soil samples will be collected for VOCs and metals COCs at continuous 2-foot intervals from 2 to 4 feet bgs to the 2-foot interval just above the water table (bottom of the vadose zone), as determined by the Tetra Tech Field Sampler;
- Separate portions of each 2-foot interval will be monitored with a PID for VOC vapors in accordance with FSPM Section 6.2.6;
- The two samples that will be sent for analysis will be the 2-foot interval with the highest PID reading and the 2-foot interval just above the water table, unless that is the same sample, in which case the 2-foot interval above that depth will also be submitted for analysis.

Soil samples for fixed-base VOC laboratory analysis must be collected at the same time as the field screening. The VOC samples will be obtained with the EnCore® sampling device in accordance with FSPM Section 5.3.1.6, which is a preferred method of the NJDEP. Field preservation of the samples is not required with this sampling technique. If selected for QC analyses, enough sample volume must also be obtained to support field (i.e., field duplicate) and laboratory (i.e., matrix spike/matrix spike duplicate [MS/MSD]) QC sample analyses. Soil visual inspection, logging, and sampling will be performed in accordance with procedures outlined in FSPM Sections 5.3.1.8, 6.2.3, and 6.2.7/6.2.8, respectively.

The specific depth interval from which any soil sample is collected, including samples for screening, will be recorded on the boring logs and soil sample collection log sheets. All results of the PID monitoring and screening will be recorded on boring logs and on soil sample collection log sheets.

Metals – All soil samples selected for VOCs analysis will also be analyzed at Chemtech for the list of metals identified in **Worksheet #9.0**.

TCLP VOCs and TCLP Metals – Depending on whether the results of the soil total VOCs and metals analyses indicate a potential TCLP criterion exceedance, up to eight samples will be analyzed for TCLP VOCs and TCLP metals to determine the potential disposal options for the soil that will be excavated during the remediation of the West Ditch, if excavation is deemed necessary. Only indications of potential TCLP exceedance will be followed by TCLP. If none of the samples contain VOCs or metals

COCs at total concentrations that exceed the PALs based on the TCLP criteria identified in **Worksheet #9.0**, then no samples will be analyzed for TCLP VOCs or TCLP metals.

Piezometer Installation and Development

Groundwater samples will be collected by the O&M Contractor from piezometers installed along the West Ditch during the remediation of the 36-inch CMP. At this time, the number of piezometers, their depths, and their method(s) of installation are not known because the type and degree of remediation and restoration to be performed along the West Ditch are not known. The results of the sewer video survey and the results of the soil sampling program will be used to identify the nature of the infiltration problem and to complete a Remedial Action Design document that recommends and describes the type of remedial action and restoration to be performed. Conceptually, it is anticipated that the piezometers will be 2-inch-diameter pre-filter packed polyvinyl chloride (PVC) wells that are placed in the backfill material as the assumed excavation is filled. The wells should be screened from the base of the excavation (probable top of bedrock) to near the ground surface in order to capture the fluctuating water table and entire overburden saturated zone at any time of the year. Should this construction method not be practical as agreed to by the Project Team, the wells could be installed through either DPT or hollow-stem auger drilling technology.

Groundwater Level Measurements

Groundwater elevation measurements will be taken by the O&M Contractor or by the USGS after the remedial action is complete and the piezometers have been installed. For the purposes of the infiltration study, it is only necessary to obtain the groundwater elevations from the West Ditch piezometers and the Site 1 overburden monitoring wells. These measurements may be obtained with continuous recorders or by monthly gauging, and the work must be coordinated with Pierre Lacombe of the USGS, in the event that the USGS wishes to concurrently measure groundwater elevations in the bedrock monitoring wells or flow measurements within the West Ditch sewer. The frequency of the measurement rounds cannot be predicted at this time because this will depend to a large extent on the type of remedial action and restoration that has occurred. However, it is anticipated that water levels will be obtained on a monthly basis for one year after remediation, and include several rounds that are biased towards events such as:

1. Significant periods of precipitation;
2. Significant periods of drought;
3. Immediately prior to any shutdown of the groundwater extraction system; and
4. Approximately one week after the groundwater extraction system is restarted.

<u>Groundwater Sampling</u>

Different methods of purging and sampling are used at NAWC Trenton by the O&M Contractor depending on the type of well construction. Overburden wells are sampled through the Low Flow Purging and Sampling method. The sampling method for each well is listed in **Worksheet #8.5**. Note that wells will be sampled in the order of least-contaminated to most-contaminated, based on historical water quality data.

Water quality parameters (pH, specific conductance, temperature, turbidity, ORP, and DO) will be measured in groundwater from permanent monitoring well locations, piezometer locations, and from surface water locations. These data will be used to determine whether representative sampling conditions have been achieved before sampling. The final readings will be used to characterize water quality at each location. The SOP for field measurement collections that will be followed is in Section 6.9.2.2 of the FSPM (NJDEP, 2005) which is referenced in **Worksheet #8.4**. Monitoring well information including total depth, open hole/screened intervals, location coordinates, reference elevations, and well diameters is included in **Appendix A**. Below is a brief description of the sampling methods.

<u>Low Flow Purging and Sampling</u> - Groundwater sampling for shallow overburden wells will be conducted by the O&M Contractor following the procedures outlined in FSPM Section 6.9.2.2.

A 2-inch diameter, variable speed submersible pump and controller (e.g., Grundfos) with disposable Teflon-lined tubing will be used for all groundwater sample purging and collection activities, in combination with a continuous flow-through cell suitable for taking water quality measurements. Measurements with the turbidimeter will be made using a separate field turbidimeter that is specifically designed to measure turbidity only. The turbidity sample will be collected downstream of the flow-through cell.

<u>Surface Water Sampling</u>

Surface water samples from the storm sewer manholes will be collected by the O&M Contractor at the same time that the monitoring wells and piezometers are sampled using the procedures outlined in FSPM Section 6.8.2.2.3. Grab samples will be collected by the O&M Contractor starting downstream at the outfall to Gold Run and moving upstream with a pole and a disposable collection bottle. The samples will be collected starting downstream at the outfall to Gold Run, moving upstream along the Navy Line to Manhole MH-117, and then moving northward along the West Ditch to the influent headwall (assuming that the spring is still culverted post-construction). The manhole lids will be removed using the appropriate tools as needed (crow bars, lifting hooks, etc.). Within the open storm drain manholes are two inlets and one outlet associated with two stormwater pipes. The pipe located parallel to Parkway Avenue is the town line (one inlet and one outlet), and the pipe located perpendicular to the road is the Navy line (inlet only). The amount of flowing water from both inlets will be estimated and recorded prior to sampling. **Figure 6** details the manhole locations from which the surface water samples will be collected.

Global Positioning System Locating

A GPS survey conducted by Tetra Tech will be used to establish all soil boring locations in a Geographic Information System (GIS) in accordance with the NJDEP "GPS Data Collection Standards for GIS Data Development" (NJDEP, 2007). The northing and easting coordinates will be recorded and referenced to the New Jersey State Plane Coordinate System. The locations of the piezometer well locations will be surveyed after they are installed, and the groundwater monitoring well and surface water locations are documented in the LTM SAP.

A GPS unit will be used to locate all sampling points to within 5 meters of truth, with a 95 percent level of confidence. The GPS equipment will be checked on control monuments before and after day's use, and these checks will be documented in the field notebook. The NJDEP guidance requires a minimum of four satellites to capture a position to ensure acceptable accuracy; for this project sub-meter accuracy of the location is not required. If accuracy requirements are not attainable at any location for any reason, such as trees, buildings, valleys, or any other interference, this will be documented in the field notes.

Depth intervals are best measured using a tape measure or other device with similar accuracy and precision (e.g., a water level meter). The horizontal coordinates must be documented in U.S. survey feet using the New Jersey State Plane Coordinate System, which is based on the North American Datum of 1983 (NAD83) for easting and northing, and the vertical coordinates must be documented using the North American Vertical Datum of 1988 (NAVD88) in order to accurately map the sampling locations.

Investigation-Derived Waste Management

Solid or semi-solid IDW in the form of soil will be generated during the collection of subsurface soil samples using DPT, which will be drummed at the site for appropriate disposal based on the analytical results.

Water will be generated by the O&M Contractor during well purging and sampling of the wells and during decontamination procedures. Disposition of the purge water will be determined based on results of historic sampling data and will be in accordance with the procedures outlined in FSPM Section 2.4.5.7 and the following:

- Purge water from wells that have historically contained less than 50 µg/L of total VOCs will be pumped to the ground downgradient of the well. If there is a possibility that water purged to the ground will enter nearby storm drains, the water will be containerized and transported to the GWTP. Disposal of the containerized water will be coordinated with the treatment plant operator. Contained purge water will then be discharged to the GWTP for treatment.

- Purge water from wells that have historically contained greater than 50 µg/L of total VOCs and purge water from the new piezometers that have never been sampled will be containerized and transported to the GWTP. Disposal of the containerized water will be coordinated with the treatment plant operator. Contained purge water will be discharged to the GWTP for treatment.

Used personal protective equipment (PPE) will be bagged and disposed of as regular trash in an appropriate facility waste container.

Field Decontamination Procedures

Sample containers will be provided certified-clean (I-Chem 300 or equivalent) from the analytical laboratory. Decontamination of sampling equipment (e.g., submersible pumps) will be conducted prior to and between sampling at each location. At each location, an abbreviated decontamination procedure consisting of a soapy water (laboratory-grade detergent) rinse followed by a deionized water rinse will be performed. However, if free-product is encountered, a more elaborate decontamination of equipment will be conducted in accordance with the procedures outlined in FSPM Sections 2.4.4 and 2.4.5.1.2.1.

Field Documentation Procedures

Field documentation will be performed in accordance with FSPM Section 6.2.4. Matrix-specific sample log sheets will be maintained for each sample collected. In addition, sample collection information will be recorded in bound field notebooks or specific field forms. Samples will be packaged and shipped accordance with FSPM Section 11.

A summary of all field activities will be properly recorded in indelible ink in a bound logbook with consecutively numbered pages that cannot be removed. Logbooks will be assigned to field personnel and will be stored in a secured area when not in use.

All entries will be written in indelible ink and no erasures will be made. If an incorrect entry is made, striking a single line through the incorrect information will make the correction; the person making the correction will initial and date the change. Boring logs, sampling forms, and other field forms will also be used to document field activities.

Quality Control Tasks

Quality assurance (QA)/QC samples will be collected at frequencies listed in **Worksheet #6.0**.

8.3 ADDITIONAL PROJECT-RELATED TASKS

Additional project-related tasks include:

- Analytical Tasks
- Data Management
- Data Review
- Project Reports

Analytical Tasks

Chemical analyses of soil samples will be performed by Chemtech, which is a current DoD Environmental Laboratory Accreditation Program (ELAP)-accredited and NJDEP National Environmental Laboratory Accreditation Program (NELAP) certified laboratory (DoD ELAP and NJDEP accreditation documentation are included in **Appendix C**). Chemical analyses of groundwater and surface water samples will be performed by the O&M Contractor's subcontract laboratory, which will be identified in an addendum to this SAP or may be covered under the NAWC Trenton LTM SAP, depending on the specific sample(s). Analyses will be performed in accordance with the analytical methods identified in **Worksheet #8.6**. Chemtech will meet the PALs specified in **Worksheet #9.0** and will perform the chemical analyses following the laboratory-specific SOPs identified in **Worksheet #10.0**. Copies of the Laboratory SOPs are available to the Project Team upon request.

All soil results will be reported by the laboratory on an adjusted dry-weight basis. Results of percent moisture will be reported in each analytical data package and associated electronic data deliverable (EDD) files. This information will also be captured in the project database, which will eventually be uploaded to the Naval Installation Restoration Information Solution (NIRIS) database. Percent moisture information will also be captured in the Groundwater Infiltration Investigation Report.

The analytical data packages provided by Chemtech will be in a Contract Laboratory Program (CLP)-like format and will be fully validatable and contain raw data, summary forms for all sample and laboratory method blank data, and summary forms containing all method-specific QC information (results, percent recoveries [%Rs], relative percent differences [RPDs], relative standard deviations [RSDs], percent differences or percent drifts [%Ds], etc.).

Data Management

The principal data generated for this project will be from field data and laboratory analytical data. Field sampling log sheets will be organized by date and medium, and filed in the project files. The field logbooks for this project will be used only for this site and will also be categorized and maintained in the project files after the completion of the field program. Project personnel completing concurrent field sampling activities may maintain multiple field logbooks. When possible, logbooks will be segregated by sampling activity. The field logbooks will be titled based on date and activity.

The data handling procedures to be followed by Chemtech will meet the requirements of the technical specifications. Electronic data results will be automatically downloaded into the Tetra Tech database in accordance with the proprietary Tetra Tech processes.

The Tetra Tech PM (or designee) is responsible for the overall tracking and control of data generated for the project.

- **Data Tracking**. Data are tracked from generation to archiving in the Tetra Tech project-specific files. The Tetra Tech Project Chemist (or designee) is responsible for tracking the samples collected and shipped to Chemtech. Upon receipt of the data packages from Chemtech, the Tetra Tech Project Chemist will monitor the data validation effort, which includes verifying that the data packages are complete and results for all samples have been delivered by Chemtech.

- **Data Storage, Archiving, and Retrieval**. The data packages received from Chemtech are tracked in the data validation logbook. After the data are validated, the data packages are entered into the Tetra Tech Navy CLEAN file system and archived in secure files. The field records including field log books, sample logs, chain-of-custody records, and field calibration logs will be submitted by the Tetra Tech FOL to be entered into the Navy CLEAN file system prior to archiving in secure project files. Project files are audited for accuracy and completeness. At the completion of the Navy contract, the records will be stored by Tetra Tech.

- **Data Security**. Access to Tetra Tech project files is restricted to designated personnel only. Records can only be borrowed temporarily from the project file using a sign-out system. The Tetra Tech Data Manager maintains the electronic data files, and access to the data files is restricted to qualified personnel only. File and data backup procedures are routinely performed.

- **Electronic Data**. All electronic data will be compiled into a NIRIS Electronic Data Deliverable (NEDD) and loaded into NIRIS.

Data Review

This review comprises data verification, validation, and usability assessment. The data verification and validation processes and requirements are described in **Worksheet #12.0**. The data usability assessment will, at a minimum, constitute evaluation of the following characteristics to ensure that the amount, type, and quality of data are sufficient to achieve project objectives. The means of conducting these evaluations will vary depending on the nature of the data. For example, soil borings and well construction logs will generally be evaluated qualitatively or semi-quantitatively whereas precision, accuracy, and sensitivity of analytical data will generally be evaluated quantitatively and may be based on, or may supplement, data validation findings. Examples include:

- Comparing actual to intended sampling locations and verifying that the correct datum was used to delineate contamination.
- Evaluating trends across sample delivery groups or sampling events.
- Assessing quantitative relationships between parameters (e.g., relative magnitudes of lead and other MC metals).
- Identifying potential errant or outlier data points.
- Assessing planning assumption validity.
- Evaluating the potential for contamination of samples by samplers.

DQIs to be evaluated during this assessment include:

1. **Precision.** A semi-quantitative estimate of the uncertainty in contaminant concentrations as a function of location will be made.

2. **Accuracy.** Accuracy data will be evaluated to ensure sampling and measurement accuracy is within or exceeds analytical method specifications and may depend in part on the data validation findings.

3. **Representativeness.** This evaluation will assess whether the data are adequately representative of intended populations based on the sample collection and data generation requirements specified in this SAP.

4. **Completeness.** Failure to obtain critical data from planned locations will be documented. Minor variations in actual versus intended sampling locations (or depths) that do not adversely affect the attainment of project objectives will not be documented.

5. **Comparability.** This will be accomplished by comparing overall precision and bias among data sets for each matrix and analytical fraction for each sampled area. This will not require quantitative comparisons unless the Tetra Tech Project Chemist indicates that such quantitative analysis is beneficial to the project and the Tetra Tech PM agrees.

6. **Sensitivity.** The Tetra Tech Project Chemist will determine whether project sensitivity goals were achieved by comparing non-detect values to PALs.

7. **Other quantitative characteristics.** These may include quantities such as verification of soil volume calculations, soil disposal cost estimates, etc., that are used to determine whether the contaminants are sufficiently well delineated to support an evaluation of potential remedies.

If significant data quality deficiencies are detected that prevent the attainment of project objectives, then the limitations on the affected data will be described in the project report. The Tetra Tech PM will bring these deficiencies to the attention of the Project Team for their evaluation and the Project Team will determine an appropriate corrective action depending on the circumstances.

<u>Project Report</u>

The Groundwater Infiltration Investigation Report will include the following:

- Executive Summary – a brief description of the work conducted and the findings.

- Introduction and Background – a description of the history of operations and activities at the site and a summary of any previous investigations and removal actions.

- Description of Field Investigations – a summary of the work performed in the approved SAP and any field modifications as documented by the Tetra Tech FOL and the O&M Contractor FOL. This section will include maps showing the sampling locations and tables summarizing the data collected.

Data Quality – a summary of quantitative analytical performance indicators such as completeness, precision, bias, and sensitivity, as well as qualitative indicators such as representativeness and comparability. Includes a reconciliation of project data with the DQOs and an identification of deviations from this SAP. A data usability assessment will be used to identify significant deviations in analytical performance that could affect the ability to meet project objectives.

- Analytical Results and Findings – Tables summarizing the data will be presented in this section.

- Summary and Conclusions – a summary of the findings, a conclusion assessing whether delineation of contamination is required, and a recommendation for further investigations, if needed.

The Tetra Tech PM will respond to comments received on the draft report. The final version of the report will be submitted in hardcopy and electronic format to the project stakeholders.

8.4 FIELD SOPS REFERENCE TABLE

(UFP-QAPP Manual Section 3.1.2 – Worksheet #21)

Reference Number[1]	Title, Revision Date and/or Number	Originating Organization of Sampling SOP	Equipment Type	Modified for Project Work? (Y/N)	Comments
2.4	Field Decon (August 2005)	NJDEP	Analyte-free water, brushes, Alconox	N	None.
2.4.2	Three-Step Equipment Decon (August 2005)	NJDEP	Analyte-free water, brushes, Alconox	N	None.
2.4.4	Field-Site Cleaning Procedure for Submersible Pumps and Pump Tubing (August 2005)	NJDEP	Analyte-free water, brushes, Alconox	N	None.
2.4.5.1.1.1	Submersible Purging Pump Decon (August 2005)	NJDEP	Analyte-free water, brushes, Alconox	N	None.
2.4.5.1.2.1	Decontamination Procedure for Submersible Pumps (Low Flow Purging and Sampling Method) (August 2005)	NJDEP	Analyte-free water, brushes, Alconox	Y	Pumps will not be disassembled between each sampling location.
2.4.5.3	Direct Push Equipment Decon (August 2005)	NJDEP	Analyte-free water, brushes, Alconox	N	None.
2.4.5.7	Disposal of Installation, Development, Purge, Pump Test, and Decontamination Waters (IDW) (August 2005)	NJDEP	55-gallon drums	N	None.
2.5.5	Sample Handling (August 2005)	NJDEP	Sample Bottle ware, Packaging Material, Shipping Materials	N	None.
2.6	Sample Preservation (August 2005)	NJDEP	NA	N	Also see FSPM Table 2.6 for details.
5.2.1.2	Peristaltic Pump (August 2005)	NJDEP	Pumps	N	None.
5.2.1.11	Passive Diffusion Bag (PDB) Samplers (August 2005)	NJDEP	PDB Samplers	N	None.
5.2.1.12	DPT Groundwater Sampling (August 2005)	NJDEP	Submersible pump, multiparameter meter, turbidimeter	N	None.
5.2.3	Surface Water and Sampling Equipment (August 2005)	NJDEP	Multi-parameter water quality meter, such as a Horiba U-22	N	None.
5.3.1.6	Encore Sampler (VOCs) (August 2005)	NJDEP	Encore sampler	N	None.

Reference Number[1]	Title, Revision Date and/or Number	Originating Organization of Sampling SOP	Equipment Type	Modified for Project Work? (Y/N)	Comments
5.3.1.8	DPT Soil Sampling (August 2005)	NJDEP	Sampling Procedures, Methods	N	None.
6.2.3	Borehole Soil Logging (August 2005)	NJDEP	General field supplies	N	None.
6.2.3.2	USCS Soil Classification (August 2005)	NJDEP	NA	N	None.
6.2.4	Field Log Books Documentation (August 2005)	NJDEP	Field Logbook, Field Sample Forms, Boring Logs	N	None.
6.2.6	Field Soil Screening by PID (August 2005)	NJDEP	PID	N	None.
6.2.7	Soil Sampling - VOCs (August 2005)	NJDEP	Sampling Procedures, Methods	N	None.
6.2.7.2	Soil Sampling - VOCs (August 2005)	NJDEP	Sampling Procedures, Methods	N	None.
6.2.7.3	Soil Sampling - VOCs (August 2005)	NJDEP	Sampling Procedures, Methods	N	None.
6.2.7.4	Soil Sampling - VOCs (Encore) (August 2005)	NJDEP	Sampling Procedures, Methods	N	None.
6.2.7.5	Soil Screening by PID and Moisture (August 2005)	NJDEP	PID	N	None.
6.2.8	Soil Sampling – Non-VOCs (August 2005)	NJDEP	Sampling Procedures, Methods	N	None.
6.4	DPT (August 2005)	NJDEP	DPT rig, accessories, and general field supplies	N	None.
6.6.3.1	Waste Classification (August 2005)	NJDEP	NA	N	None.
6.8.2.2	Surface Water Sampling (August 2005)	NJDEP	Multi-parameter water quality meter, such as a Horiba U-22	N	None.
6.8.2.2.1	Stream Sampling (Flowing Water) (August 2005)	NJDEP	Multi-parameter water quality meter, such as a Horiba U-22	N	None.
6.8.2.2.3	Surface Water Grab Sampling (August 2005)	NJDEP	Pole and disposable sample collection bottle	Y	None.
6.8.2.4.7.1	Water Levels (August 2005)	NJDEP	Electronic water level indicator	N	None.
6.9.2.1	DPT Sampling (August 2005)	NJDEP	Submersible pump, multiparameter meter, turbidimeter	N	None.
6.9.2.2	Low Flow Purging and Sampling (August 2005)	NJDEP	Submersible pump, multiparameter meter, turbidimeter	N	None.

Reference Number[1]	Title, Revision Date and/or Number	Originating Organization of Sampling SOP	Equipment Type	Modified for Project Work? (Y/N)	Comments
6.9.2.2.5.2	Water Quality Indicators (August 2005)	NJDEP	Multi-parameter water quality meter, such as a Horiba U-22	N	None.
6.9.2.2.5.5	Flow-Through Cell (August 2005)	NJDEP	Multi-parameter water quality meter, such as a Horiba U-22	N	None.
6.9.2.2.5.8	Calibration of Probes (August 2005)	NJDEP	Multi-parameter water quality meter, such as a Horiba U-22, turbidimeter	N	None.
6.9.2.2.5.9	Water Levels (August 2005)	NJDEP	Electronic water level indicator	N	None.
6.9.2.2.5.12	Sampling (August 2005)	NJDEP	Sampling Procedures, Methods	N	None.
6.9.2.3	Low Flow Purging and Sampling (Low Yield Wells) (August 2005)	NJDEP	Submersible Pump	N	None.
6.9.2.4	Volume-Averaged Purging and Sample Collection (August 2005)	NJDEP	Submersible Pump	N	None.
6.9.2.5	Point Source (No-Purge) Sampling (August 2005)	NJDEP	NA	N	No purging required if recovery wells have been active for 24 hours before collection.
6.9.2.5.1	Passive Diffusion Bag Samplers (August 2005)	NJDEP	PDB Samplers	N	The O&M Contractor will provide and install.
6.9.8	Water Levels (August 2005)	NJDEP	Sampling Procedures, Methods	N	None.
10	Sample Custody (August 2005)	NJDEP	NA	N	None.
10.5.1	Sample Labeling (August 2005)	NJDEP	NA	N	None.
11	Sample Shipment (August 2005)	NJDEP	NA	N	None.
11.7	Sample Labeling (August 2005)	NJDEP	NA	N	None.
A.6.1.3.3	DPT Well Installation (August 2005)	NJDEP	Well drilling and installation equipment, hydrogeologic equipment, drive point tools	N	None.
A.6.1.4.8	Pre-Packed Well Screens (August 2005)	NJDEP	Well screens	N	None.
A.6.1.5.1	DPT Well Development (August 2005)	NJDEP	Submersible Pump	N	None.
NA	NJDEP GPS Data Collection Standards for GIS Data Development (October 2007)	NJDEP	Differential GPS	N	None.

[1] Field Procedures are from the NJDEP Field Sampling Procedures Manual (August 2005) under the Sections listed as the Reference Number.

8.5 SAMPLE DETAILS TABLE

(UFP-QAPP Manual Section 3.1.1 and 3.5.2.3 – Worksheet #18)

Sampling Location	ID Number	Matrix	Depth (feet bgs)	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference[1]	Sampling Rationale
Soil Borings (One time sampling event)							
SB-01	SB-01-XXXX[2]-01 and SB-DUP-01[3]	Soil	2-foot interval with highest PID reading	VOCs[4]	2	6.4, 6.2.7, 6.2.8	Potential source identification and waste disposal characterization.
				Metals[4]	2		
	SB-01-XXXX[2]-02 and SB-DUP-02[3]	Soil	2-foot interval just above water table	VOCs[4]	2		
				Metals[4]	2		
SB-02	SB-02-XXXX[2]-01	Soil	2-foot interval with highest PID reading	VOCs[4]	1	6.4, 6.2.7, 6.2.8	
				Metals[4]	1		
	SB-02-XXXX[2]-02	Soil	2-foot interval just above water table	VOCs[4]	1		
				Metals[4]	1		
SB-03	SB-03-XXXX[2]-01	Soil	2-foot interval with highest PID reading	VOCs[4]	1	6.4, 6.2.7, 6.2.8	
				Metals[4]	1		
	SB-03-XXXX[2]-02	Soil	2-foot interval just above water table	VOCs[4]	1		
				Metals[4]	1		
SB-04	SB-04-XXXX[2]-01	Soil	2-foot interval with highest PID reading	VOCs[4]	1	6.4, 6.2.7, 6.2.8	
				Metals[4]	1		
	SB-04-XXXX[2]-02	Soil	2-foot interval just above water table	VOCs[4]	1		
				Metals[4]	1		
SB-05	SB-05-XXXX[2]-01	Soil	2-foot interval with highest PID reading	VOCs[4]	1	6.4, 6.2.7, 6.2.8	
				Metals[4]	1		
	SB-05-XXXX[2]-02	Soil	2-foot interval just above water table	VOCs[4]	1		
				Metals[4]	1		
SB-06	SB-06-XXXX[2]-01	Soil	2-foot interval with highest PID reading	VOCs[4]	1	6.4, 6.2.7, 6.2.8	
				Metals[4]	1		
	SB-06-XXXX[2]-02	Soil	2-foot interval just above water table	VOCs[4]	1		
				Metals[4]	1		
SB-07	SB-07-XXXX[2]-01	Soil	2-foot interval with highest PID reading	VOCs[4]	1	6.4, 6.2.7, 6.2.8	
				Metals[4]	1		
	SB-07-XXXX[2]-02	Soil	2-foot interval just above water table	VOCs[4]	1		
				Metals[4]	1		
SB-08	SB-08-XXXX[2]-01	Soil	2-foot interval with highest PID reading	VOCs[4]	1	6.4, 6.2.7, 6.2.8	
				Metals[4]	1		

Sampling Location	ID Number	Matrix	Depth (feet bgs)	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference[1]	Sampling Rationale
	SB-08-XXXX[2]-02	Soil	2-foot interval just above water table	VOCs[4]	1		
				Metals[4]	1		
Piezometer Locations (Quarterly for four consecutive quarters after remedial design completion)							
PZ-A	PZ-A- YYYYMMDD[5] and PZ-DUP-01[3]	Ground-water	TBD	VOCs	2	6.8, 6.9	Quality of groundwater within West Ditch backfill that is either migrating within the overburden or discharging from the bedrock.
PZ-B	PZ-B- YYYYMMDD[5]	Ground-water	TBD	VOCs	1	6.8, 6.9	
PZ-C	PZ-C- YYYYMMDD[5]	Ground-water	TBD	VOCs	1	6.8, 6.9	
…Up to PZ-N	…Up to PZ-N-YYYYMMDD[5], where N may be “D” to “J” for an anticipated 4 to 10 locations	Ground-water	TBD	VOCs	1	6.8, 6.9	
Monitoring Well Locations (Quarterly for four consecutive quarters after remedial design completion)							
MW-4S	MW-4S-YYYYMMDD[5]	Ground-water	3–7	VOCs	1	6.8, 6.9	Immediately downgradient of Site 3 source area.
MW-40S	MW-40S-YYYYMMDD[5]	Ground-water	3–13	VOCs	1	6.8, 6.9	Quality of downgradient overburden groundwater in the vicinity of the West Ditch between the ditch and the soil removal area.
MW-41S	MW-41S-YYYYMMDD[5]	Ground-water	3–13	VOCs	1	6.8, 6.9	Quality of downgradient overburden groundwater in the vicinity of the West Ditch and within the soil removal area.
MW-1S	MW-1S-YYYYMMDD[5]	Ground-water	3–13	VOCs	1	6.8, 6.9	Quality of overburden groundwater in the vicinity of the West Ditch headwall.

Sampling Location	ID Number	Matrix	Depth (feet bgs)	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference[1]	Sampling Rationale
WDW	WDW-YYYYMMDD[5]	Ground-water	0–8	VOCs	1	6.8, 6.9	Quality of mixed surface water/ groundwater at West Ditch CMP outfall.
Surface Water Locations (Quarterly for four consecutive quarters after remedial design completion)							
OF-1A (Culvert Headwall)	OF-1A –YYYYMMDD[5]	Surface water	NA	VOCs	1	6.8.2	Determine quality of surface water entering the West Ditch sewer line.
Port 001	Port 001-YYYYMMDD[5]	Surface water	NA	VOCs	1	6.8.2	Determine quality of surface water entering the West Ditch from the lateral draining the area between Building 41 and Building 42.
OF-1B (MH140)	OF-1B –YYYYMMDD[5]	Surface water	NA	VOCs	1	6.8.2	Determine quality of surface water at downgradient extent of the older (currently unrepaired) segment of the West Ditch sewer line.
OF-1C (Oil/Water Separator Influent)	OF-1C –YYYYMMDD[5]	Surface water	NA	VOCs	1	6.8.2	Determine quality of surface water discharging from the 36-inch CMP segment of the West Ditch.
Oil/Water Separator Effluent (OWS-EF)	OWS-EF-YYYYMMDD[5]	Surface water	NA	VOCs	1	6.8.2	Determine potential volatilization of VOCs within separator, and determine quality of surface water before it enters the steel pipe discharging to Outfall 1.
MH-117N	MH-117N –YYYYMMDD[5]	Surface water	NA	VOCs	1	6.8.2	Four rectangular manholes located under the sidewalk on
MH-117T	MH-117T –YYYYMMDD[5]	Surface water	NA	VOCs	1	6.8.2	

Sampling Location	ID Number	Matrix	Depth (feet bgs)	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference[1]	Sampling Rationale
MH-118.5N	MH-118.5N–YYYYMMDD[5]	Surface water	NA	VOCs	1	6.8.2	the north side of Parkway Avenue, to be used to measure the quality of the water discharging to the Parkway Avenue sewer system. "N" samples are collected from the Navy discharge point and "T" samples are collected from the Township's discharge point.
MH-118.5T	MH-118.5T–YYYYMMDD[5]	Surface water	NA	VOCs	1	6.8.2	
MH-121.5N	MH-121.5N–YYYYMMDD[5]	Surface water	NA	VOCs	1	6.8.2	
MH-121.5T	MH-121.5T–YYYYMMDD[5]	Surface water	NA	VOCs	1	6.8.2	
MH125.9N	MH125.9N–YYYYMMDD[5]	Surface water	NA	VOCs	1	6.8.2	
MH125.9T	MH125.9T–YYYYMMDD[5]	Surface water	NA	VOCs	1	6.8.2	
GR-OF	GR-OF-YYYYMMDD[5]	Surface water	NA	VOCs	1	6.8.2	Outfall to Gold Run located on Ewing Township owned property.

[1] SOP or worksheet that describes the sample collection procedures (**Worksheet #8.4**).
[2] XXXX represents depth of the sample. Depth will be determined in the field. For example, if sample is collected from 5 to 6 feet, the depth will be recorded as 0506.
[3] Field duplicate locations may change in the field at the discretion of the Tetra Tech Geologist based on visual and olfactory observations and PID readings for soil samples. The intent will be to target those locations that exhibit the greatest degree of visual and/or organic vapor and the 2-foot interval just above the water table to increase the likelihood of generating meaningful data. Field duplicate locations for all piezometer and monitoring well groundwater and surface water samples will be selected by the O&M Contractor field sampler.
[4] For soil samples, if a VOCs or metals PAL (based on TCLP criteria) is exceeded, as identified in **Worksheet #9.0**, then that sample will also be analyzed for TCLP Leachate for TCLP VOCs and/or TCLP metals based on any corresponding PAL exceedances.
[5] YYYYMMDD represents the date of the sample collection for the quarterly sampling events. For example, if sample GR-OF is collected on March 13, 2012, the sample ID will be recorded as GR-OF-20120313.

8.6 ANALYTICAL SOP REQUIREMENTS AND ANALYTICAL SERVICES TABLE
(UFP-QAPP Manual Section 3.1.1 - Worksheets #19 and 30)

Laboratory point of contact, e-mail address, and phone number: Kurt Hummler, khummler@chemtech.net, 908-728-3143
Laboratory Name and Address: Chemtech, 284 Sheffield Street, Mountainside, NJ 07092
Data Package Turnaround time: 21 days
Tentative Sampling Dates: Fall 2011

Matrix	Analytical Group	Analytical and Preparation Method / SOP Reference[1]	Containers (number, size, and type)	Sample Volume (units)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation / analysis)
Soil	VOCs	SW-846 5035A/ 8260B/ SOP M8260B-C-SWGCMSVOA	Three - 5 gram (g) Encore samplers or terracores	5 g	Sodium bisulfate in water; cool to ≤6 °C (do not freeze); methanol, cool to ≤6 °C (do not freeze); deionized water; freeze to < -10 °C	48 hours from sampling to preparation, 14 days to analysis
	Metals	SW-846 6010C; SW-846 7471A for mercury/ SOP M6010B-C-Trace Elements; M7471A-B-Mercury	1 – 4-ounce (oz) glass jar	1 to 2 g / 0.3 g for mercury	Cool to ≤6 °C (do not freeze)	180 days to analysis, except mercury; 28 days to analysis for mercury
Soil	TCLP VOCs	SW-846 1311/8 260B/ SOP M1311-TCLP/ M8260B-C-SWGCMSVOA	1 – 4-oz glass jar	5 g	Cool to ≤6 °C (do not freeze)	14 days from sampling to preparation, 14 days to analysis
	TCLP Metals	SW-846 1311/ 6010C; SW-846 1311/7471A for mercury/ SOP M1311-TCLP/ M6010B-C-Trace Elements; M7471A-B-Mercury	1 – 4-oz glass jar	5 g	Cool to ≤6 °C (do not freeze)	180 days to preparation and analysis, except mercury; 28 days to preparation and analysis for mercury
Groundwater	VOCs	SW-846 5030/ 8260B/ SOP M8260B-C-SWGCMSVOA	3 - 40 milliliter (mL) vials with Teflon-lined septa	25 mL	Hydrochloric Acid (HCl) to pH<2; cool to ≤6 °C (do not freeze)	14 days to analysis
Surface Water	VOCs	SW-846 5030/ 8260B/ SOP M8260B-C-SWGCMSVOA	3 - 40mL vials with Teflon-lined septa	25 mL	HCl to pH<2; cool to ≤6 °C (do not freeze)	14 days to analysis

Notes:
[1]Specify the appropriate reference letter or number from the Analytical SOP References table (**Worksheet #10.0**).

8.7 FIELD QUALITY CONTROL SAMPLE SUMMARY TABLE

(UFP-QAPP Manual Section 3.1.1 - Worksheet #20)

Matrix	Analytical Group	No. of Sampling Locations	No. of Field Duplicates	No. of MS/MSDs[1]	No. of Field Blanks	No. of Equipment Rinsate Blanks	No. of VOC Trip Blanks	Total No. of Samples to Lab
Soil	VOCs	8	1	1/1	0	1	1	11
	Metals	8	1	1/1	0	1	NA	10
Soil (Leachate)	TCLP VOCs	Minimum of 0; maximum of 8	1	1/1	0	0	1	Minimum of 0; maximum of 10
	TCLP Metals	Minimum of 0; maximum of 8	1	1/1	0	0	NA	Minimum of 0; maximum of 9
Groundwater (Piezometers)[2] (each round)	VOCs	4 to 10	1	1/1	0	1	1	7 to 13
Groundwater (Monitoring Wells)[2] (each round)	VOCs	5	TBD	TBD	TBD	TBD	TBD	TBD
Surface Water[2] (each round)	VOCs	14	TBD	TBD	TBD	TBD	TBD	TBD

1 Although MS/MSD samples are not typically considered field QC samples, they are included here because location determination is often established in the field. MS/MSD samples are not included in the total number of samples sent to the laboratory. For metals, a matrix duplicate (MD) will be collected in place of an MSD.

2 The details for groundwater and surface water samples are included in the LTM SAP. The details for piezometer samples will be included in an addendum to this SAP or the LTM SAP will incorporate them by reference.

9.0 -- Reference Limits and Evaluation Tables

(UFP-QAPP Manual Section 2.8.1 – Worksheet #15)

Matrix: Soil
Analytical Group: VOCs

Analyte	CAS Number	PALs (mg/kg)	PAL References[1]	PQLG (mg/kg)	Chemtech		
					LOQ (mg/kg)	LOD (mg/kg)	DL (mg/kg)
1,1,1-Trichloroethane	71-55-6	0.2	Default IGW SSL	0.067	0.005	0.0025	0.00088
1,1-Dichloroethane	75-34-3	0.2	Default IGW SSL	0.067	0.005	0.0025	0.00094
1,1-Dichloroethene	75-35-4	0.005	Default IGW SSL	0.0017	0.005	0.0025	0.00147
1,2-Dichloroethane	107-06-2	0.005	Default IGW SSL	0.0017	0.005	0.0025	0.00064
Benzene	71-43-2	0.005	Default IGW SSL	0.0017	0.005	0.0025	0.00038
Bromodichloromethane	75-27-4	0.005	Default IGW SSL	0.0017	0.005	0.0025	0.00062
Chloroform	67-66-3	0.2	Default IGW SSL	0.067	0.005	0.0025	0.00074
cis-1,2-Dichloroethene	156-59-2	0.2	Default IGW SSL	0.067	0.005	0.0025	0.00089
Tetrachloroethene	127-18-4	0.005	Default IGW SSL	0.0017	0.005	0.0025	0.00101
trans-1,2-Dichloroethene	156-60-5	0.4	Default IGW SSL	0.13	0.005	0.0025	0.00069
Trichloroethene	79-01-6	0.007	Default IGW SSL	0.0023	0.005	0.0025	0.00086
Vinyl chloride	75-01-4	0.005	Default IGW SSL	0.0017	0.005	0.0025	0.00123

Notes:
CAS – Chemical Abstracts Service
PAL – Project Action Limit
mg/kg – Milligrams per kilogram
PQLG – Project Quantitation Limit Goal
[1]PAL References – Default IGW SSL – NJDEP Default Impact to Groundwater Soil Screening Level, Table 1 of NJDEP Guidance Document "Development of Site-Specific Impact to Ground Water Soil Remediation Standards Using the Soil-Water Partition Equation", (NJDEP, December 2008).

Matrix: Soil
Analytical Group: Metals

Analyte	CAS Number	PALs (mg/kg)	PAL References[1]	PQLG (mg/kg)	Chemtech		
					LOQ (mg/kg)	LOD (mg/kg)	DL (mg/kg)
Aluminum	7429-90-5	3,900	Default IGW SSL	1,300	5	2.5	0.84
Arsenic	7440-38-2	19*	Default IGW SSL	6.3	1	0.5	0.33
Barium	7440-39-3	1,300	Default IGW SSL	430	5	2.5	0.4
Cadmium	7440-43-9	1	Default IGW SSL	0.33	0.03	0.15	0.06
Chromium	7440-47-3	NC	None	0.67	0.5	0.25	0.13
Iron	7439-89-6	NC	None	NC	5	2.5	1.33
Lead	7439-92-1	59	Default IGW SSL	20	0.6	0.3	0.12
Manganese	7439-96-5	42	Default IGW SSL	14	1	0.5	0.19
Mercury	7439-97-6	0.1	Default IGW SSL	0.033	0.01	0.005	0.002
Nickel	7440-02-0	31	Default IGW SSL	10	2	1	0.46

Notes:
NC – No Criteria
[1]PAL References – Default IGW SSL – NJDEP Default Impact to Groundwater Soil Screening Level, Table 1 of NJDEP Guidance Document “Development of Site-Specific Impact to Ground Water Soil Remediation Standards Using the Soil-Water Partition Equation”, (NJDEP, December 2008).

- - Health based criterion defaults to background.

Matrix: Soil (TCLP Leachate)
Analytical Group: TCLP VOCs

Analyte	CAS Number	PAL (mg/L)	PAL Reference[1]	PQLG (mg/L)	Chemtech		
					LOQ (mg/L)	LOD (mg/L)	DL (mg/L)
1,1,1-Trichloroethane	71-55-6	NC	None	NC	0.025	0.0125	0.002
1,1-Dichloroethane	75-34-3	NC	None	NC	0.025	0.0125	0.0018
1,1-Dichloroethene	75-35-4	0.7	TCLP	0.23	0.025	0.0125	0.00235
1,2-Dichloroethane	107-06-2	0.5	TCLP	0.17	0.025	0.0125	0.0024
Benzene	71-43-2	0.5	TCLP	0.17	0.025	0.0125	0.0016
Bromodichloromethane	75-27-4	NC	None	NC	0.025	0.0125	0.0018
Chloroform	67-66-3	6.0	TCLP	2.0	0.025	0.0125	0.0017
cis-1,2-Dichloroethene	156-59-2	NC	None	NC	0.025	0.0125	0.00175
Tetrachloroethene	127-18-4	0.7	TCLP	0.23	0.025	0.0125	0.00135
trans-1,2-Dichloroethene	156-60-5	NC	None	NC	0.025	0.0125	0.00205
Trichloroethene	79-01-6	0.5	TCLP	0.17	0.025	0.0125	0.0014
Vinyl chloride	75-01-4	0.2	TCLP	0.067	0.025	0.0125	0.0017

Notes:
mg/L – Milligrams per liter
[1]PAL References – TCLP – USEPA Toxicity Characteristic Leaching Procedure regulatory limits for hazardous waste designation from 40 CFR 261.

Matrix: Soil (TCLP Leachate)
Analytical Group: TCLP Metals

Analyte	CAS Number	PAL (mg/L)	PAL Reference[1]	PQLG (mg/L)	Chemtech		
					LOQ (mg/L)	LOD (mg/L)	DL (mg/L)
Aluminum	7429-90-5	NC	None	NC	0.05	0.025	0.0065
Arsenic	7440-38-2	5.0	TCLP	1.7	0.01	0.005	0.0042
Barium	7440-39-3	100	TCLP	33	0.05	0.025	0.004
Cadmium	7440-43-9	1.0	TCLP	0.33	0.003	0.0015	0.0005
Chromium	7440-47-3	5.0	TCLP	1.7	0.005	0.0025	0.0011
Iron	7439-89-6	NC	None	NC	0.05	0.025	0.0204
Lead	7439-92-1	5.0	TCLP	1.7	0.006	0.003	0.0026
Manganese	7439-96-5	NC	None	NC	0.01	0.005	0.0017
Mercury	7439-97-6	0.2	TCLP	0.067	0.0002	0.0001	0.00009
Nickel	7440-02-0	NC	None	NC	0.02	0.01	0.0042

Notes:
[1]PAL References – TCLP – USEPA Toxicity Characteristic Leaching Procedure regulatory limits for hazardous waste designation from 40 CFR 261.

Matrix: Groundwater
Analytical Group: VOCs

Analyte	CAS Number	PAL (µg/L)	PAL Reference[1]	PQLG (µg/L)	O&M Subcontract Laboratory		
					LOQ (µg/L)	LOD (µg/L)	DL (µg/L)
1,1,1-Trichloroethane	71-55-6	30	GWQS	10	TBD	TBD	TBD
1,1-Dichloroethane	75-34-3	50	GWQS	17	TBD	TBD	TBD
1,1-Dichloroethene	75-35-4	1	GWQS	0.33	TBD	TBD	TBD
1,2-Dichloroethane	107-06-2	2	GWQS (PQL)	0.67	TBD	TBD	TBD
Benzene	71-43-2	1	GWQS (PQL)	0.33	TBD	TBD	TBD
Bromodichloromethane	75-27-4	1	GWQS (PQL)	0.33	TBD	TBD	TBD
Chloroform	67-66-3	70	GWQS	23	TBD	TBD	TBD
cis-1,2-Dichloroethene	156-59-2	70	GWQS	23	TBD	TBD	TBD
Tetrachloroethene	127-18-4	1	GWQS (PQL)	0.33	TBD	TBD	TBD
trans-1,2-Dichloroethene	156-60-5	100	GWQS	33	TBD	TBD	TBD
Trichloroethene	79-01-6	1	GWQS	0.33	TBD	TBD	TBD
Vinyl chloride	75-01-4	1	GWQS (PQL)	0.33	TBD	TBD	TBD

Notes:
[1]PAL References: GWQS - NJDEP Groundwater Quality Standard from N.J.A.C 7:9C (http://www.state.nj.us/dep/wms/bwqsa/gwqs.htm). References identified as GWQS (PQL) are the higher of the Practical Quantitation Limit and the risk-based Groundwater Quality Standard Criterion, as identified in the standard.

Matrix: Surface Water
Analytical Group: VOCs

Analyte	CAS Number	PAL (µg/L)	PAL Reference[1]	PQLG (µg/L)	O&M Subcontract Laboratory		
					LOQ (µg/L)	LOD (µg/L)	DL (µg/L)
1,1,1-Trichloroethane	71-55-6	120	SWQS	40	TBD	TBD	TBD
1,1-Dichloroethane	75-34-3	NC	None	NC	TBD	TBD	TBD
1,1-Dichloroethene	75-35-4	4.7	SWQS	1.6	TBD	TBD	TBD
1,2-Dichloroethane	107-06-2	0.29	SWQS	0.097	TBD	TBD	TBD
Benzene	71-43-2	0.15	SWQS	0.050	TBD	TBD	TBD
Bromodichloromethane	75-27-4	0.55	SWQS	0.18	TBD	TBD	TBD
Chloroform	67-66-3	68	SWQS	23	TBD	TBD	TBD
cis-1,2-Dichloroethene	156-59-2	NC	None	NC	TBD	TBD	TBD
Tetrachloroethene	127-18-4	0.34	SWQS	0.11	TBD	TBD	TBD
trans-1,2-Dichloroethene	156-60-5	590	SWQS	197	TBD	TBD	TBD
Trichloroethene	79-01-6	1	SWQS	0.33	TBD	TBD	TBD
Vinyl chloride	75-01-4	0.082	SWQS	0.027	TBD	TBD	TBD

Notes:
[1]PAL Reference – SWQS: NJDEP Surface Water Quality Standard from N. J. A. C. 7:9B (http://www.state.nj.us/dep/wms/bwqsa/docs/0608_SWQS.pdf)

10.0 -- Analytical SOP References Table

(UFP-QAPP Manual Section 3.2.1 – Worksheet #23)

Lab SOP Number	Title, Revision Date, and / or Number	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis	Variance to DOD QSM? (Y/N)	Modified for Project Work? (Y/N)
M8260BB-C-SWGCMS VOA, TBD	Volatile Organic Compounds by GC/MS – SW-846 Method 8260B/C (Revision 18, 02/15/11)	Definitive	Soil, Groundwater, and Surface Water VOCs	Gas Chromatograph/ Mass Spectrometer (GC/MS)	Chemtech	N	N
M6010B-C-Trace Elements	Trace Elemental Analysis by Inductively Coupled Plasma-Atomic Emission Spectrometric Method (Revision 18, 05/25/11)	Definitive	Soil Metals	Inductively Coupled Plasma Atomic Emission Spectrometer (ICP-AES) or Mass Spectrometer (ICP-MS)	Chemtech	N	N
M7471A-B-Mercury	Mercury Analysis in Soil and Sediments by Cold Vapor Technique (Revision 11, 05/23/11)	Definitive	Soil Mercury	Cold Vapor Atomic Absorption (CVAA)	Chemtech	N	N
M7470A-Mercury	Mercury Analysis in Liquid Waste by Cold Vapor Technique (Revision 11, 05/15/10)	Definitive	Aqueous Field QC Samples Mercury	Cold Vapor Atomic Absorption (CVAA)	Chemtech	N	N
M1311-TCLP	Sample Preparation for Toxicity Characteristics Leachate Procedure (Revision 7, 05/23/11)	Definitive	Soil Leachate VOCs and Metals	Zero Headspace Extractor (ZHE) Extraction and TCLP Extraction	Chemtech	N	N

11.0 -- Laboratory QC Samples Tables

(UFP-QAPP Manual Section 3.4 – Worksheet #28)

Matrix	Soil, Groundwater*, Surface Water*, and Aqueous Field QC Samples
Analytical Group	VOCs
Analytical Method/ SOP Reference	SW-846 8260B/ M8260B-C-SWGCMSVOA, TBD

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person(s) Responsible for CA	DQIs	MPCs
Method Blank	One per batch of 20 samples or less per matrix.	All target analytes must be ≤ ½ LOQ, except common lab contaminants, which must be < LOQ.	Investigate source of contamination. Reanalyze all associated samples. Flag 'B' for laboratory contamination for all associated samples.	Analyst, Supervisor	Bias / Contamination	Same as QC Acceptance Limits.
Surrogates	All field and QC samples. The number of surrogates is laboratory specific (TBD).	Percent recovery (%R) must be within laboratory statistically-derived or Department of Defense (DoD) Quality Systems Manual (QSM) acceptance limits (Version 4.1 or current).	If sample volume available and within holding time, re-analyze affected samples.	Analyst, Supervisor	Accuracy / Bias	Same as QC Acceptance Limits.
Laboratory Control Sample (LCS) [Laboratory Control Sample Duplicate (LCSD) not required]	One per batch of 20 samples or less per matrix.	%Rs must be within laboratory statistically derived or DoD QSM acceptance limits (Version 4.1 or current). Relative Percent Difference (RPD) must be ≤ 30% (for LCS/LCSD, if analyzed).	Correct problem, then reprepare and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available. Contact Client if samples cannot be reanalyzed within hold time.	Analyst, Supervisor	Accuracy / Bias Precision also, if LCSD is analyzed	Same as QC Acceptance Limits.

Matrix	Soil, Groundwater*, Surface Water*, and Aqueous Field QC Samples
Analytical Group	VOCs
Analytical Method/ SOP Reference	SW-846 8260B/ M8260B-C-SWGCMSVOA, TBD

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person(s) Responsible for CA	DQIs	MPCs
Internal Standards (IS)	Every field sample, standard, and QC sample. The number of ISs is laboratory specific (TBD).	Retention Times (RTs) for each IS must be within ± 30 seconds and the responses must be within -50% to +100% of initial calibration (ICAL) mid-point standard.	Re-analyze affected samples.	Analyst, Supervisor, and Data Validator	Accuracy / Bias	Same as QC Acceptance Limits.
MS/MSD	One per batch of 20 samples or less per matrix.	%R should be within laboratory statistically derived or DoD QSM acceptance limits (Version 4.1 or current). RPD between MS and MSD should be ≤ 30%.	Narrate.	Analyst, Supervisor, and Data Validator	Accuracy / Bias Precision	Same as QC Acceptance Limits.
Results between the DL and LOQ	NA.	Apply "J" qualifier to results detected between DL and LOQ.	None.	Analyst, Supervisor, and Data Validator	Accuracy	Same as QC Acceptance Limits.

* For groundwater and surface water samples, the O&M Contractor will collect the samples and their subcontract laboratory will analyze the samples in general accordance with the procedures identified herein.

Matrix	Soil and Aqueous Field QC Samples
Analytical Group	Metals
Analytical Method/ SOP Reference	SW-846 6010C/ M6010B-C-Trace Elements

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQIs	MPCs
Method Blank	One per batch of 20 samples or less per matrix.	All target analytes must be ≤ ½ LOQ, except common lab contaminants, which must be < LOQ.	Investigate source of contamination. Flag 'B' for laboratory contamination for all associated samples.	Analyst, Supervisor, and Data Validator	Bias / Contamination	Same as QC Acceptance Limits.
LCS (LCSD Not Required)	One per batch of 20 samples or less per matrix.	%Rs must be within laboratory statistically derived or DoD QSM acceptance limits (Version 4.1 or current). RPD must be ≤ 20% (for LCS/LCSD, if analyzed).	Evaluate and reanalyze if possible. If the LCS recoveries are high but the sample results are <LOQ, narrate. Otherwise, re-digest and reanalyze.	Analyst, Supervisor, and Data Validator	Accuracy / Bias Precision also, if LCSD is analyzed	Same as QC Acceptance Limits.
MS/MSD	One per batch of 20 samples or less per matrix.	%Rs should be within laboratory statistically derived or DoD QSM acceptance limits (Version 4.1 or current). RPD between MS and MSD should be ≤ 20%, if MSD is analyzed.	Flag results for affected analytes for all associated samples with "N."	Analyst, Supervisor, and Data Validator	Accuracy / Bias Precision	Same as QC Acceptance Limits.
Duplicate Sample	One per batch of 20 or fewer samples per matrix (if MSD is not included).	RPD between duplicate samples should be ≤20%, if both results are >5x LOQ.	Evaluate sample homogeneity and flag as necessary.	Analyst, Supervisor, and Data Validator	Precision	Same as QC Acceptance Limits.
ICP Serial Dilution	One per batch of 20 or fewer samples per matrix on failure of MS/MSD.	The 5-fold dilution result must agree within ± 10%D of the original sample result.	Perform post-spike addition.	Analyst, Supervisor, and Data Validator	Accuracy / Bias Precision	Same as QC Acceptance Limits.
Post-Digestion Spike	When serial dilution test fails or when all analyte concentrations are <50 x LOD.	The %R must be within 75-125% of expected value to verify the absence of an interference. Spike addition should produce a concentration of 10-100x LOQ.	Flag results for affected analytes for all associated samples with "N."	Analyst, Supervisor, and Data Validator	Accuracy / Bias	Same as QC Acceptance Limits.
Results between the DL and LOQ	NA.	Apply "J" qualifier to results detected between DL and LOQ.	None.	Analyst, Supervisor, and Data Validator	Accuracy	Same as QC Acceptance Limits.

Matrix	Soil and Aqueous Field QC Samples
Analytical Group	Mercury
Analytical Method/ SOP Reference	SW-846 7470A/ 7471A / M7470A-Mercury, M7471A-B-Mercury

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQIs	MPCs
Method Blank	One per batch of 20 samples or less per matrix.	Target analyte must be ≤ ½ LOQ.	Investigate source of contamination. Flag ‘B’ for laboratory contamination for all associated samples.	Analyst, Supervisor, and Data Validator	Bias / Contamination	Same as QC Acceptance Limits.
LCS (LCSD Not Required)	One per batch of 20 samples or less per matrix.	%Rs must be within laboratory statistically derived or DoD QSM acceptance limits (Version 4.1 or current). RPD must be ≤ 20% (for LCS/LCSD, if analyzed).	Evaluate and reanalyze if possible. If the LCS recoveries are high but the sample results are <LOQ, narrate. Otherwise, re-digest and reanalyze.	Analyst, Supervisor, and Data Validator	Accuracy / Bias Precision also, if LCSD is analyzed	Same as QC Acceptance Limits.
MS/MSD	One per batch of 20 samples or less per matrix.	%Rs should be within laboratory statistically derived or DoD QSM acceptance limits (Version 4.1 or current). RPD between MS and MSD should be ≤ 20%.	Flag results for affected analytes for all associated samples with “N.”	Analyst, Supervisor, and Data Validator	Accuracy / Bias Precision	Same as QC Acceptance Limits.
Duplicate Sample	One per batch of 20 or fewer samples per matrix (if MSD is not included).	RPD between duplicate samples should be ≤20%, if both results are >5x LOQ.	Evaluate sample homogeneity and flag as necessary.	Analyst, Supervisor, and Data Validator	Precision	Same as QC Acceptance Limits.
Results between the DL and LOQ	NA.	Apply “J” qualifier to results detected between DL and LOQ.	None.	Analyst, Supervisor, and Data Validator	Accuracy	Same as QC Acceptance Limits.

Method acceptance criteria for accuracy results are interim guidelines. Actual acceptance criteria are updated based on the requirements of SW-846 Method 8000B and the laboratory’s QC requirements as defined in their Laboratory QA Manual and are provided to the Tetra Tech Project Chemist by the Laboratory PM for use in data validation.

12.0 -- Data Verification and Validation (Steps I and IIa/IIb) Process Table

(UFP-QAPP Manual Section 5.2.1, UFP-QAPP Manual Section 5.2.2, Figure 37 UFP-QAPP Manual, Table 9 UFP-QAPP Manual – Worksheets #34, 35, 36)

Data Review Input	Description	Responsible for Verification (name, organization)	Internal/ External
Chain of Custody Forms	The Tetra Tech FOL or designee will review and sign the chain-of-custody form to verify that all samples listed are included in the shipment to the laboratory and the sample information is accurate. The forms will be signed by the sampler and a copy will be retained for the project file, the Tetra Tech PM, and the Tetra Tech Data Validators. The Tetra Tech FOL or designee will review the chain-of-custody form to verify that all samples listed in the SAP have been collected. All deviations should be documented in the report.	Sampler and FOL, Tetra Tech	Internal
Chain of Custody Forms	1 - The Laboratory Sample Custodian will review the sample shipment for completeness and integrity, and sign accepting the shipment. 2- The Tetra Tech Data Validators will check that the chain-of-custody form was signed and dated by the Tetra Tech FOL or designee relinquishing the samples and also by the Laboratory Sample Custodian receiving the samples for analyses.	1 - Laboratory Sample Custodian, Chemtech 2 - Data Validators, Tetra Tech	External
Chain of Custody Forms and SAP	Ensure that the custody and integrity of the samples was maintained from collection to analysis and the custody records are complete and any deviations are recorded. Review that the samples were shipped and stored at the required temperature and preservation conditions for chemically-preserved samples meet the requirements listed in the SAP. Ensure that the analyses were performed within the holding times listed in the SAP.	Data Validators, Tetra Tech	External
Sample Log Sheets, Chain of Custody Forms, SAP, and Laboratory Sample Login Documentation	Verify that information recorded in the log sheets is accurate and complete. Verify that samples were correctly identified, that sampling location coordinates are accurate, and that documentation establishes an unbroken trail of documented chain-of-custody from sample collection to report generation. Verify that the correct sampling and analytical methods/SOPs were applied. Verify that the sampling plan was implemented and carried out as written and that any deviations are documented. Document any discrepancies in the final report.	PM, FOL, or designee, Tetra Tech	Internal

Data Review Input	Description	Responsible for Verification (name, organization)	Internal/ External
SAP, Analytical SOPs, and Analytical Data Packages	Ensure that all laboratory SOPs were followed. Verify that the correct analytical methods/SOPs were applied. Establish that all method QC samples were analyzed and in control as listed in the analytical SOPs. If method QA is not in control, the Laboratory QAM will contact the Tetra Tech PM verbally or via e-mail for guidance prior to report preparation.	Laboratory QAM, Chemtech	Internal
SAP/ Chain-of-Custody Forms	Check that all field QC samples determined necessary were collected as required.	FOL or designee, Tetra Tech	Internal
Analytical Data Packages	Verify all analytical data packages for completeness. The Laboratory QAM will sign the case narrative for each data package.	Laboratory QAM, Chemtech	Internal
EDDs/ Analytical Data Packages	Check each EDD against the chain-of-custody and hard copy data package for accuracy and completeness. Compare laboratory analytical results to the electronic analytical results to verify accuracy. Evaluate sample results for laboratory contamination and qualify false detections using the laboratory method/preparation blank summaries. Qualify analyte concentrations between the DL and the LOQ as estimated. Remove extraneous laboratory qualifiers from the validation qualifier.	Data Validators, Tetra Tech	External
Analytical Data Packages	Verify each data package for completeness. Request missing information from the Laboratory PM.	Data Validators, Tetra Tech	External
SAP/ Laboratory Data Packages/ EDDs	Ensure that the laboratory QC samples were analyzed and that the MPCs listed in were met for all field samples and QC analyses. Check that specified field QC samples were collected and analyzed and that the analytical QC criteria set up for this project were met.	Data Validators, Tetra Tech	External
SAP/ Laboratory Data Packages/ EDDs	Check the field sampling precision by calculating RPDs for field duplicate samples. Check laboratory precision by reviewing the RPD or percent difference values from laboratory duplicate analyses; MS/MSDs; and LCS/LCSD, if available. Ensure compliance with the methods and project MPCs accuracy goals listed in the SAP.	Data Validators, Tetra Tech	External

Data Review Input	Description	Responsible for Verification (name, organization)	Internal/ External
SAP/ Laboratory Data Packages/ EDDs	Check that the laboratory recorded the temperature at sample receipt and the pH of samples preserved with acid or base to ensure sample integrity from sample collection to analysis.	Data Validators, Tetra Tech	External
SAP/ Laboratory Data Packages/ EDDs	Review the chain-of-custody forms generated in the field to ensure that the required analytical samples have been collected, appropriate sample identifications have been used, and correct analytical methods have been applied. The Tetra Tech Data Validator will verify that elements of the data package required for validation are present, and if not, the laboratory will be contacted and the missing information will be requested. Check that all data have been transferred correctly and completely to the project Structured Query Language (SQL) database.	Data Validators, Tetra Tech	External
SAP/ Laboratory Data Packages/ EDDs	Ensure that the project LOQs listed in SAP were achieved.	Data Validators, Tetra Tech	External
SAP/ Laboratory Data Packages/ EDDs	Discuss the impact on DLs that are elevated because of matrix interferences. Be especially cognizant of and evaluate the impact of sample dilutions on low-concentration analytes when the dilution was performed because of the high concentration of one or more other contaminants. Document this usability issue and inform the Tetra Tech PM. Review and add PALs to the laboratory EDDs. Flag samples and notify the Tetra Tech PM of samples that exceed PALs listed in SAP.	Data Validators, Tetra Tech	External
SAP/ Laboratory Data Packages/ EDDs	Ensure that all QC samples specified in the SAP were collected and analyzed and that the associated results were within prescribed SAP acceptance limits. Ensure that QC samples and standards prescribed in analytical SOPs were analyzed and within the prescribed control limits. If any significant QC deviations occur, the Laboratory QAM shall have contacted the Tetra Tech PM.	Data Validators, Tetra Tech	External

Data Review Input	Description	Responsible for Verification (name, organization)	Internal/ External
SAP/ Laboratory Data Packages/ EDDs	Summarize deviations from methods, procedures, or contracts in the Data Validation Report. Determine the impact of any deviation from sampling or analytical methods and SOPs requirements and matrix interferences effect on the analytical results. Qualify data results based on method or QC deviation and explain all the data qualifications. Print a copy of qualified data stored the project database to depict data qualifiers and data qualifier codes that summarize the reason for data qualifications. Determine if the data met the MPCs and determine the impact of any deviations on the technical usability of the data.	Data Validators, Tetra Tech	External
Soil, Surface Water, and Groundwater - VOCs	Full (Level IV) data validation will be performed using criteria for SW-846 Methods 8260B listed in this SAP and the current DoD QSM. The logic outlined in USEPA Region 2 SOP HW-24 Revision 2 (USEPA, 2006b) will be used to apply qualifiers to data to the extent possible.	Data Validators, Tetra Tech	External
Soil, Surface Water, and Groundwater - Metals (Including Mercury)	Full (Level IV) data validation will be performed using criteria for SW-846 Methods 6010C or 6020A, and 7470A/7471A listed in this SAP and the current DoD QSM. The logic outlined in USEPA Region 2 SOP HW-2 Revision 13 (USEPA, 2006c) will be used to apply qualifiers to data to the extent possible.	Data Validators, Tetra Tech	External

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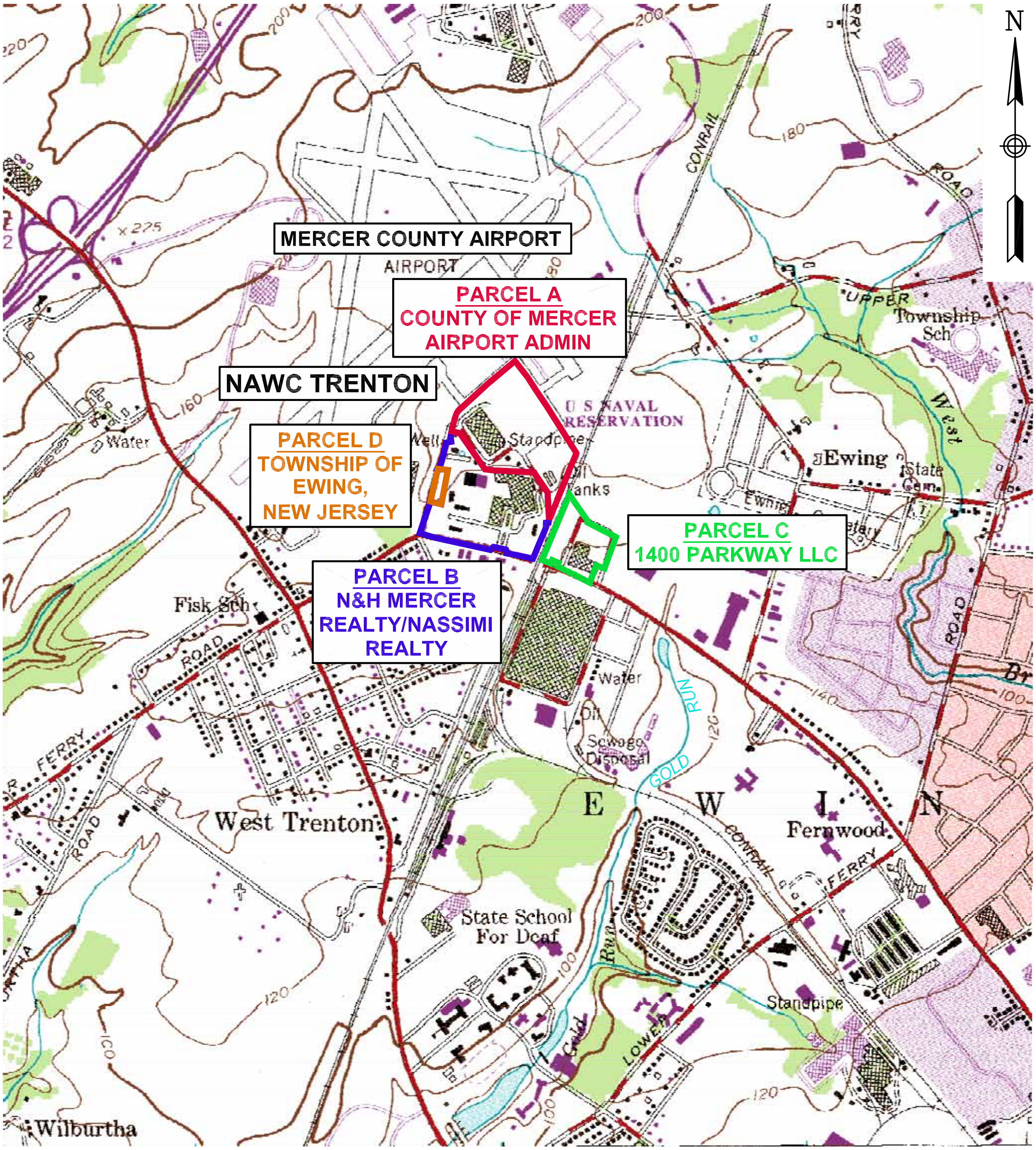
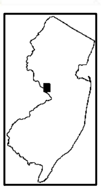
FIGURES

112G02311\LT.MP.1\112G02311BM01.DWG 07/15/11 MKB





SOURCE:
BASE MAP IS A PORTION OF THE PENNINGTON, NJ U.S.G.S. 7.5 MINUTE QUADRANGLE MAP, DATED 19543, PHOTOREVISED IN 1981.

QUADRANGLE LOCATION

0 1,600 3,200

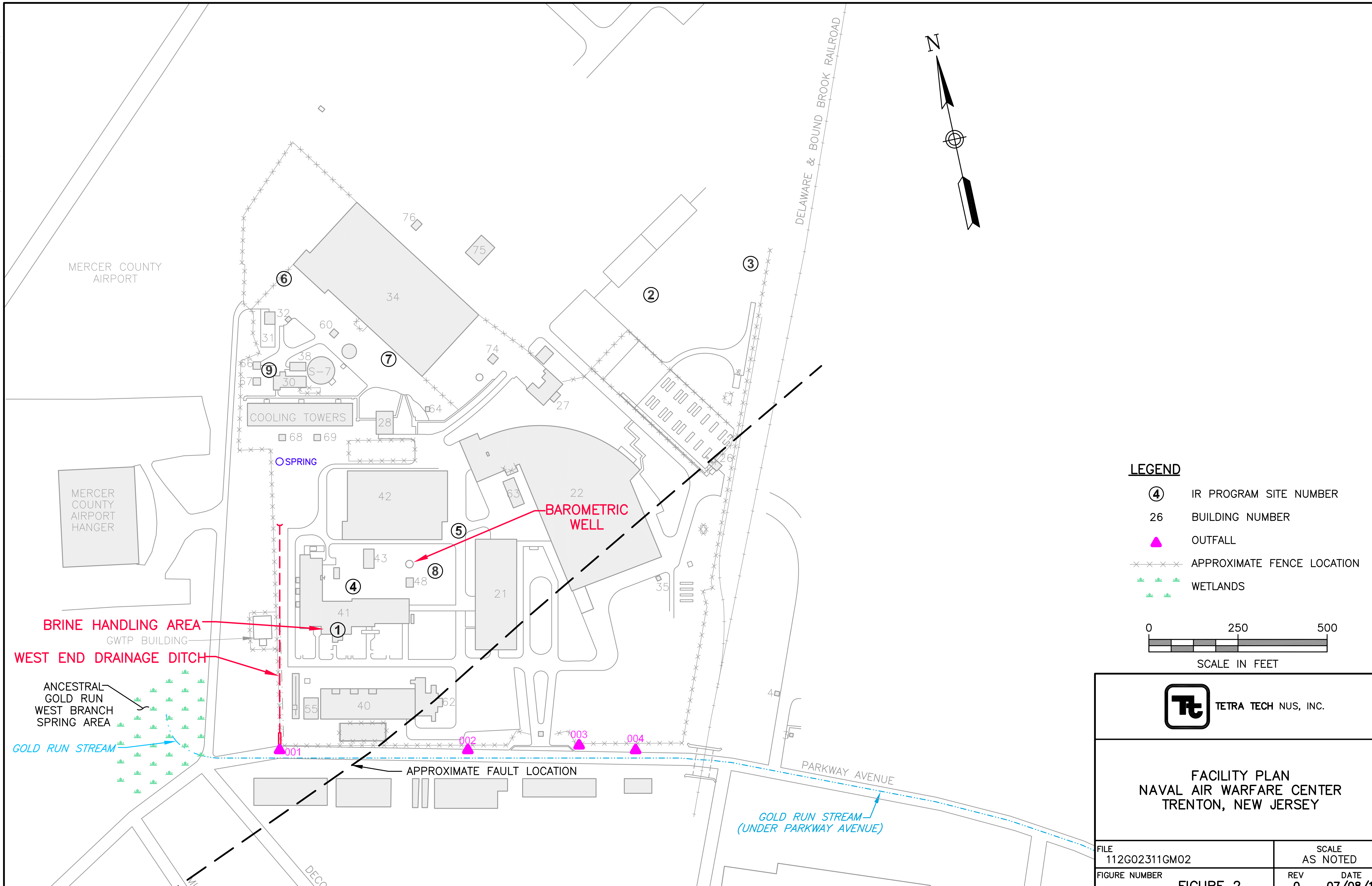
SCALE IN FEET

TETRA TECH NUS, INC.

FACILITY LOCATION MAP
NAVAL AIR WARFARE CENTER
TRENTON, NEW JERSEY

SCALE	AS NOTED
FILE	112G02311BM01
REV 0	DATE 07/15/11
FIGURE NUMBER	FIGURE 1

112G02311\LT.MP.1\112G02311GM02.DWG 07/09/11 MKB



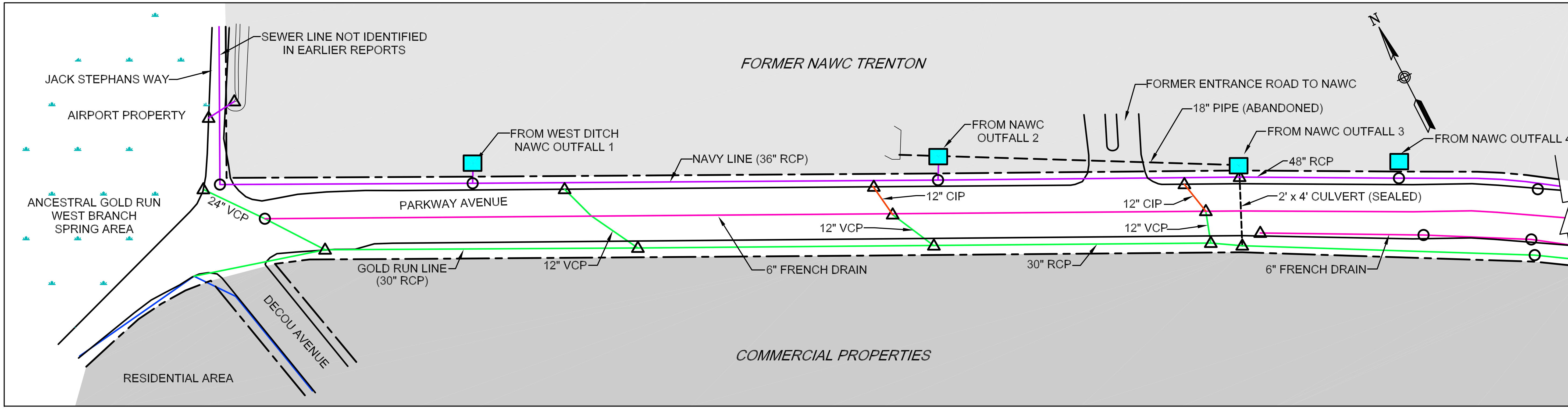
TETRA TECH NUS, INC.

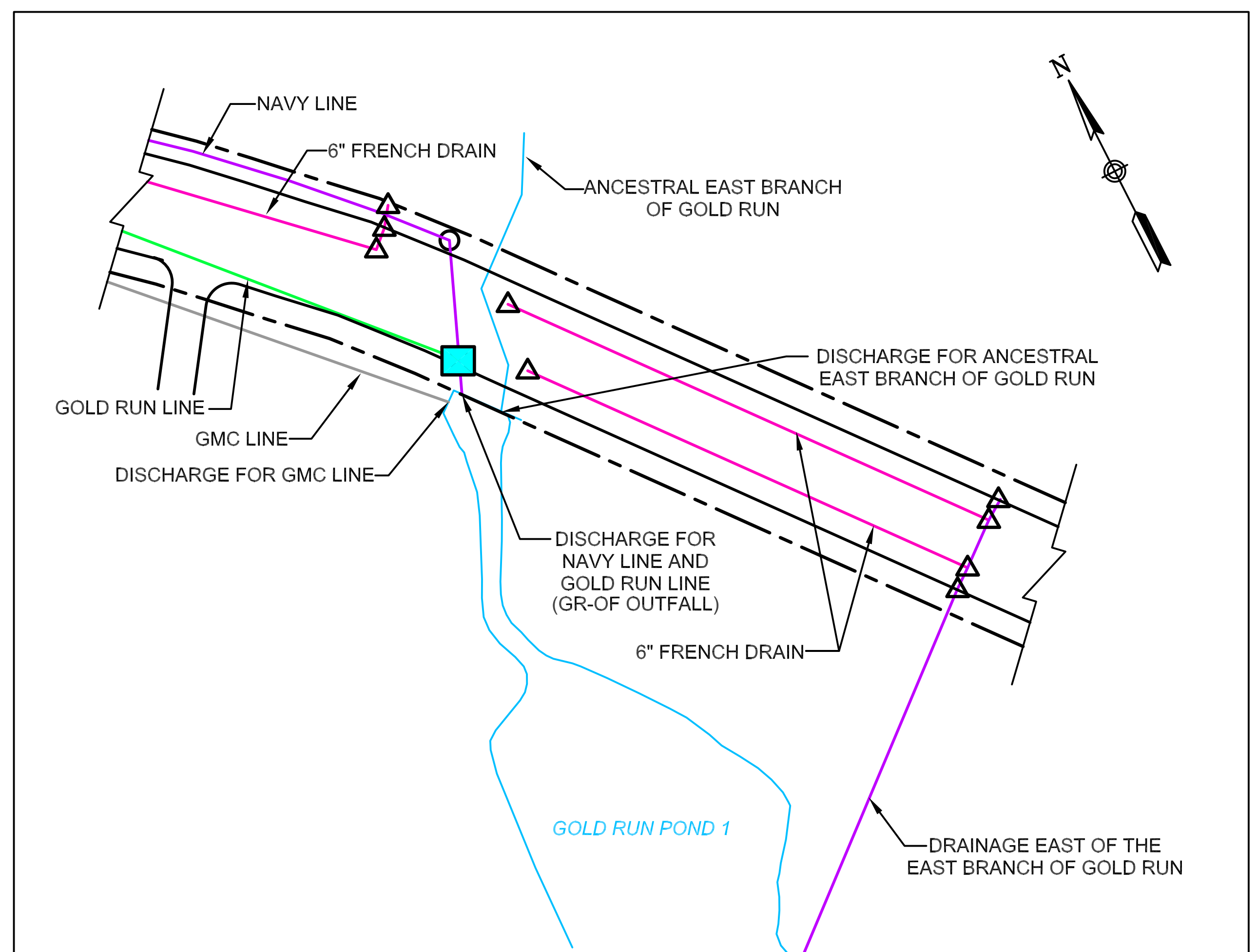
FACILITY PLAN
NAVAL AIR WARFARE CENTER
TRENTON, NEW JERSEY

FILE	SCALE
112G02311GM02	AS NOTED

FIGURE NUMBER	REV	DATE
FIGURE 2	0	07/08/11

112G02311\LT.MP.1\112G02311GM03.DWG 07/15/11 MKB





LEGEND

- NAVY LINE
- GOLD RUN LINE
- CAST IRON PIPE (CIP)
- FRENCH DRAIN (6-INCH)
- MANHOLE
- INLET
- OUTFALL
- RCP REINFORCED CONCRETE PIPE
- VCP VITRIFIED CLAY PIPE

0 100 200
SCALE IN FEET

NOTES:

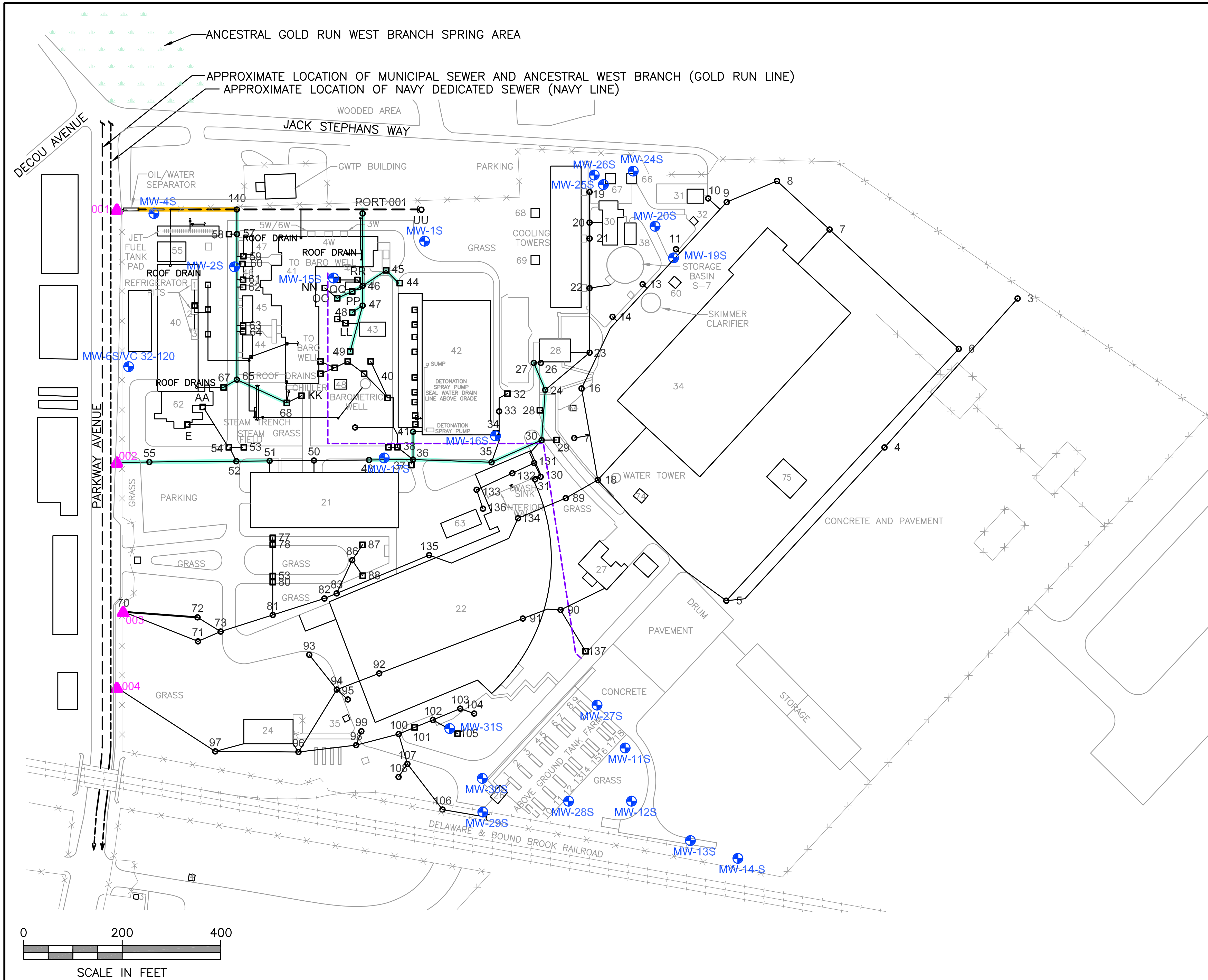
1. THE "ANCESTRAL WEST BRANCH" OF GOLD RUN CREEK BEGINS AS AN INTERMITTENT SPRING IN A WOODED AREA WEST OF NAWC TRENTON BEFORE FLOWING INTO A STORM SEWER LINE WHICH TRENDS UNDER AND PARALLEL TO PARKWAY AVENUE SOUTH OF THE BASE. THIS STORM SEWER LINE WAS INSTALLED TO FOLLOW THE FOOTPRINT OF THE ORIGINAL WEST BRANCH STREAM CHANNEL. THE LINE INITIALLY STARTS AS A 30" RCP; THE FINAL MATERIAL AT THE DISCHARGE IS A 3' x 4' FLUME.
2. THE 6" WIDE FRENCH DRAIN RUNS APPROXIMATELY 18" – 24" BELOW THE CENTER OF PARKWAY AVENUE AND TIES INTO EXISTING DRAIN LINES.
3. THE NAVY LINE IS CONSTRUCTED OF 36" RCP ALONG THE FRONT OF THE FORMER NAWC TRENTON, CHANGES TO 48" RCP AT MH-118.5 AND AT MH-114.5 CHANGES TO A 44" x 72" CORRUGATED METAL PIPE.

TETRA TECH NUS, INC.

WEST BRANCH OF GOLD RUN
NAVAL AIR WARFARE CENTER
TRENTON, NEW JERSEY

FILE	SCALE
112G02311GM03	AS NOTED

FIGURE NUMBER	REV	DATE
FIGURE 3	0	07/15/11



LEGEND

- OVERBURDEN MONITOR WELL
- OVERHEAD FUEL LINE
- OUTFALL
- 34 BUILDING NUMBER
- STORM SEWER LINE
- 36" CMP STORM SEWER LINE
- STORM SEWER MANHOLE
- STORM SEWER CATCH BASIN
- 60 MANHOLE NUMBER
- LINES REPAIRED BY CIPP
- SEGMENT OF 36" CMP THAT WAS REPLACED BY THE NAVY
- WETLANDS

TETRA TECHNUS, INC.

NAWC TRENTON STORM SEWERS AND OUTFALLS
NAVAL AIR WARFARE CENTER
TRENTON, NEW JERSEY

FILE	SCALE
112G02311GM04	AS NOTED

FIGURE NUMBER	REV	DATE
FIGURE 4	0	07/09/11

112G02311\LT.MP.1\112G02311GM04.DWG 07/09/11 MKB

112G02311\LT.MP.1\112G02311GM05.DWG 07/15/11 MKB

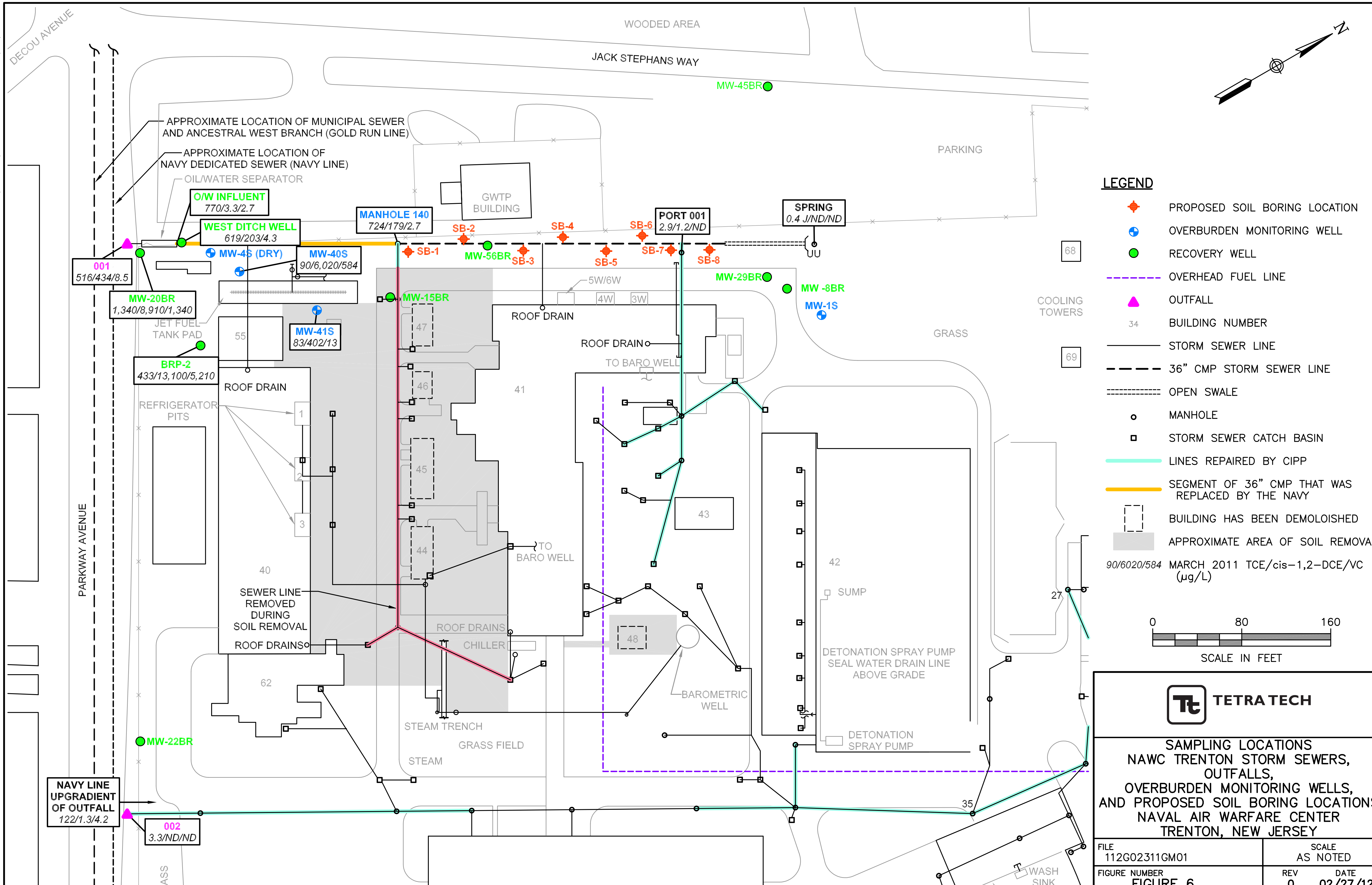
0 300 600

SCALE IN FEET

TETRA TECH NUS, INC.

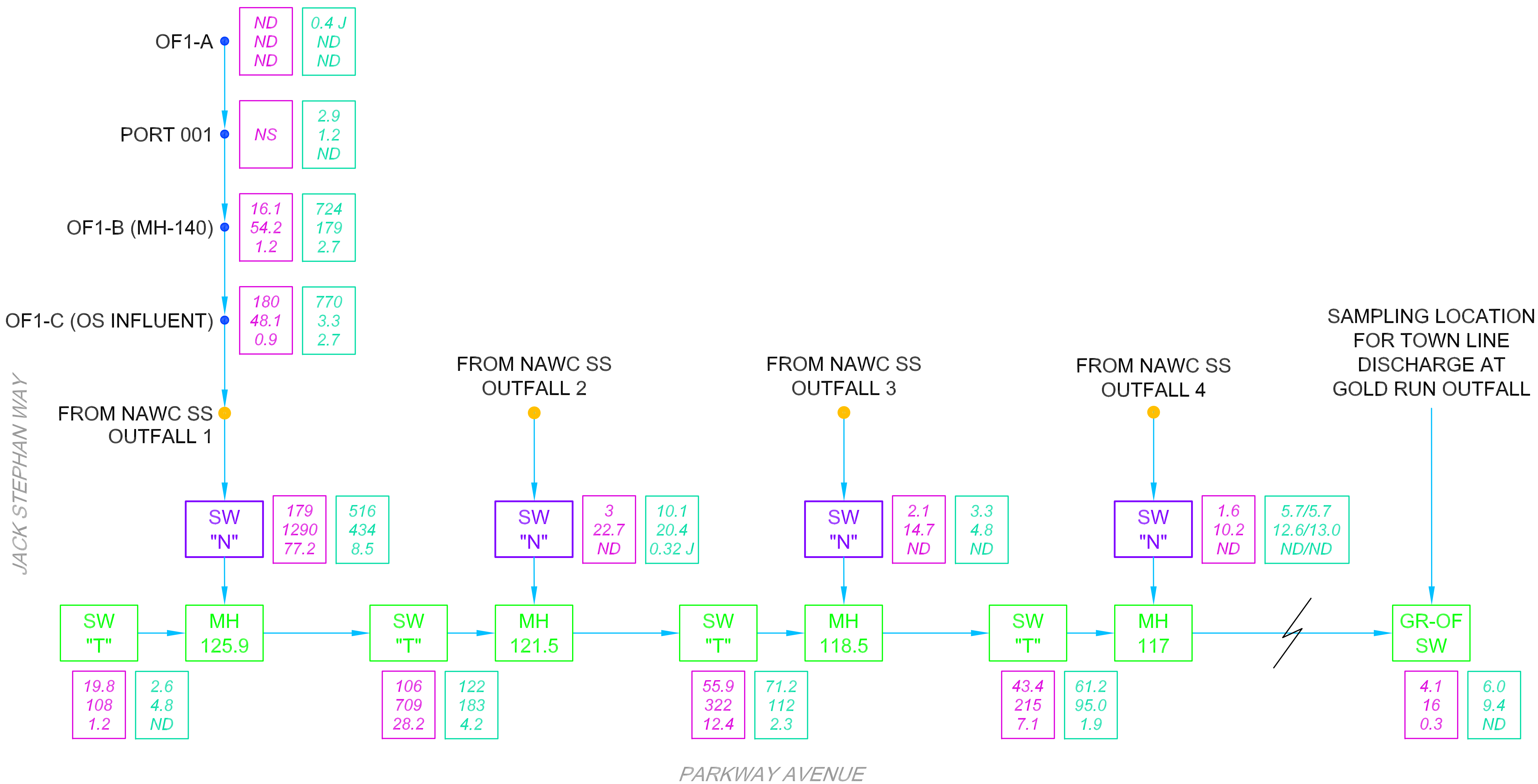
WEST DITCH PHOTOGRAGHS
NAVAL AIR WARFARE CENTER
TRENTON, NEW JERSEY

FILE 112G02311GM05	SCALE AS NOTED	
FIGURE NUMBER FIGURE 5	REV 0	DATE 07/15/11



112G02311\PL.QS.3\112G02311GM01.DWG 02/27/12 MKB

112G02311\LT.MP.1\112G02311CF01-1.DWG 07/15/11 MKB



LEGEND

DIRECTION OF WATER FLOW

SEDIMENT LOCATION

SAMPLE LOCATION

TCE (µg/L)
cis-1,2-DCE (µg/L)
VC (µg/L)

22.7 NOVEMBER 2010 CONCENTRATION

20.4 MARCH 2010 CONCENTRATION

ND NON-DETECT

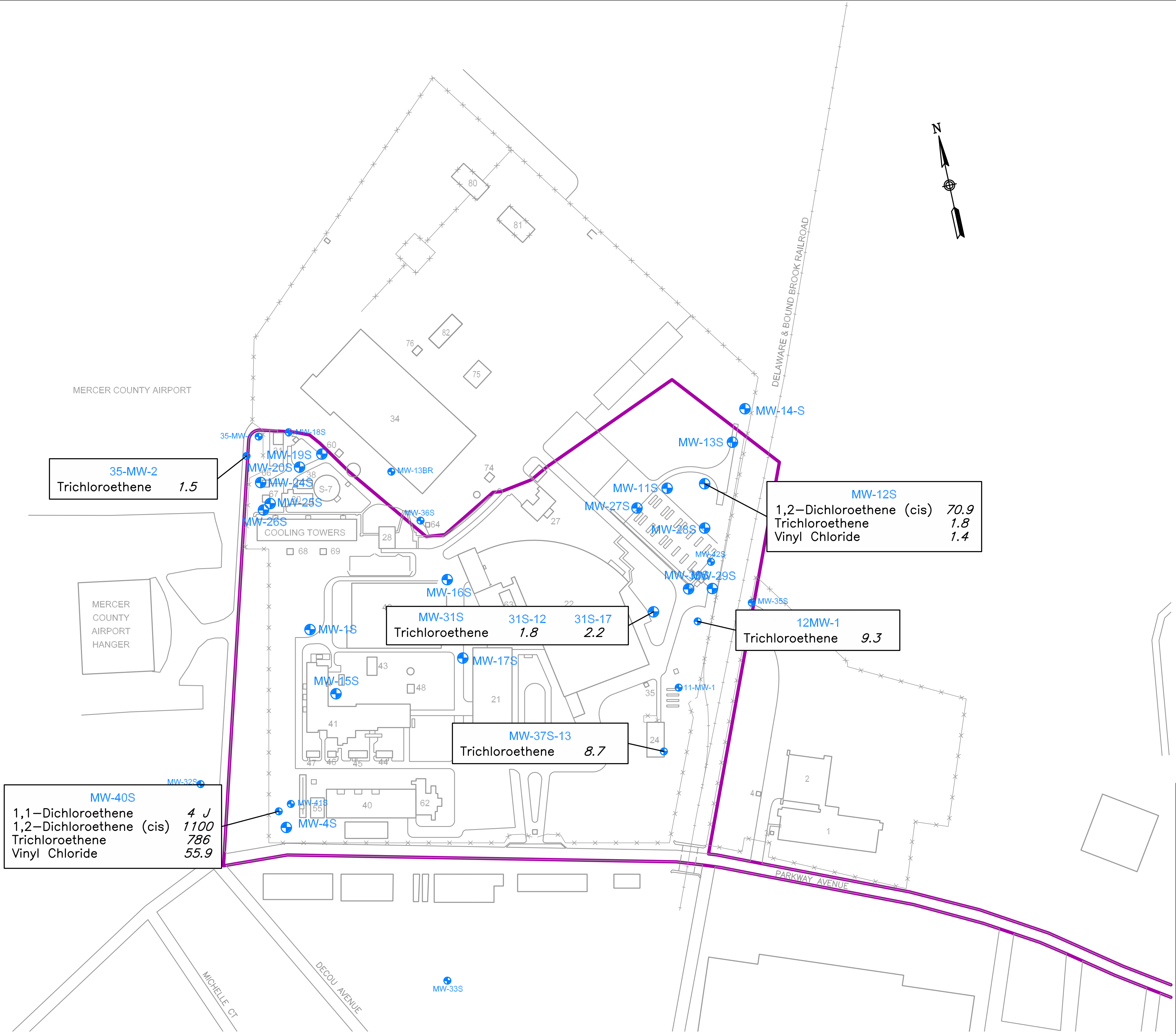
NS NOT SAMPLED

TETRA TECHNUS, INC.

OUTFALL CONCENTRATIONS
NOVEMBER 2010 AND MARCH 2011
NAVAL AIR WARFARE CENTER
TRENTON, NEW JERSEY

FILE 112G02311CF01-1	SCALE NOT TO SCALE	
FIGURE NUMBER FIGURE 7	REV 0	DATE 07/15/11

112G02311\LT.MP.1\112G02311GM06-2.DWG 07/15/11 MKB



NJDEP GWQS

1,1-DICHLOROETHENE	1	ug/L
1,2-DICHLOROETHENE(cis)	70	ug/L
1,2-DICHLOROETHENE(trans)	100	ug/L
TRICHLOROETHENE	1	ug/L
TETRACHLOROETHENE	1	ug/L
VINYL CHLORIDE	1	ug/L

LEGEND

⊕	OVERBURDEN MONITORING WELL
17.4	ANALTICAL RESULT IN ug/L
J	VALUE IS CONSIDERED ESTIMATED DUE TO EXCEEDANCE OF TECHNICAL QUALITY CONTROL CRITERIA OR BECAUSE RESULT IS LESS THAN THE CONTRACT REQUIRED QUANTITATION LIMIT (CRQL)
▬	CEA BOUNDARY

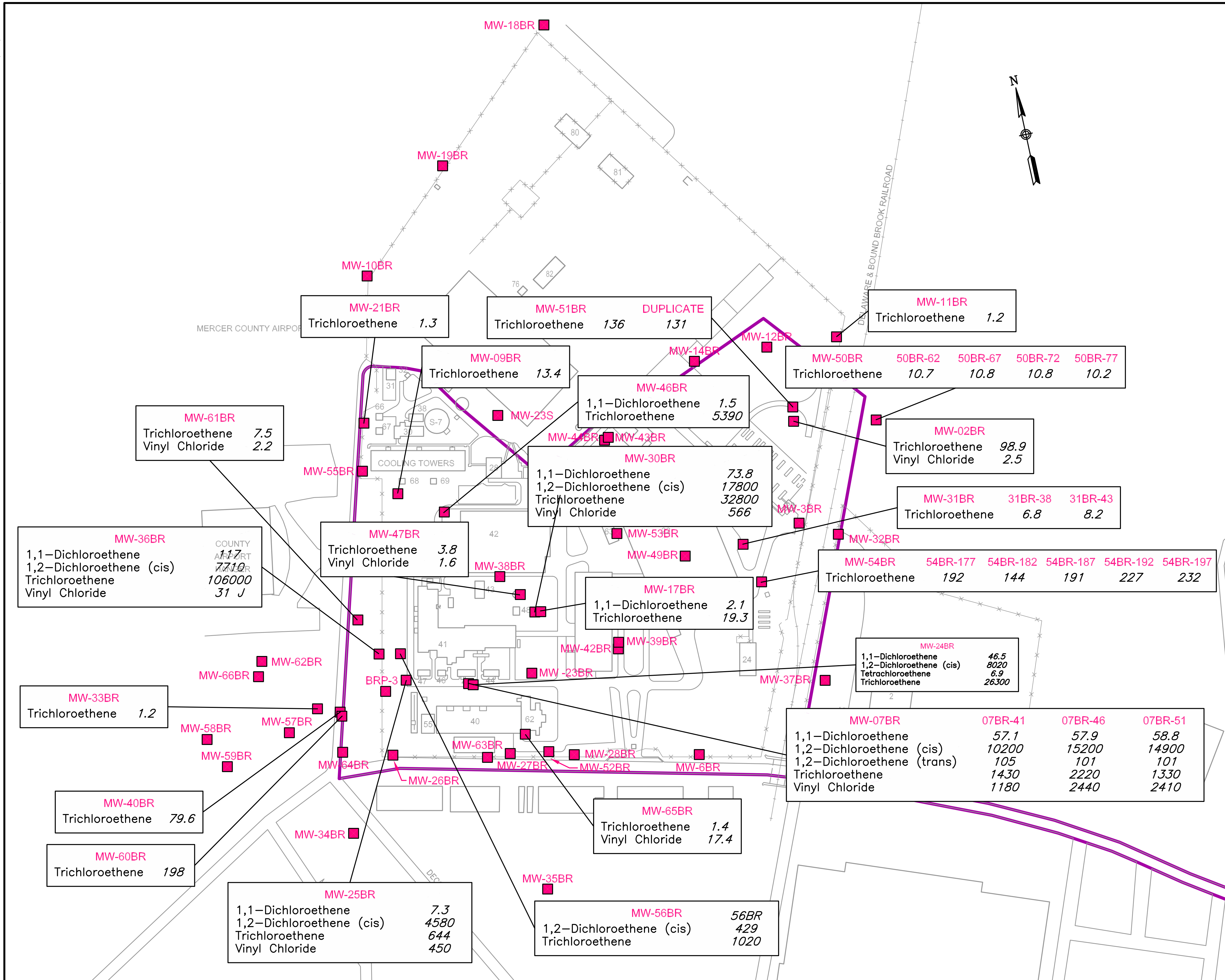
NOTE:
ALL SAMPLES WERE COLLECTED IN MAY AND JUNE OF 2007.

0 300 600
SCALE IN FEET

TETRA TECHNUS, INC.

OVERBURDEN GROUNDWATER CONCENTRATIONS ABOVE CURRENT REGULATORY CRITERIA
NAVAL AIR WARFARE CENTER
TRENTON, NEW JERSEY

FILE	SCALE
112G02311GM06-2	AS NOTED
FIGURE NUMBER: FIGURE 8	REV: 0 / DATE: 07/15/11



NJDEP GWQS

1,1-DICHLOROETHENE	1 ug/L
1,2-DICHLOROETHENE(cis)	70 ug/L
1,2-DICHLOROETHENE(trans)	100 ug/L
TRICHLOROETHENE	1 ug/L
TETRACHLOROETHENE	1 ug/L
VINYL CHLORIDE	1 ug/L

LEGEND

- BEDROCK MONITORING WELL
- *17.4* ANALTICAL RESULT IN ug/L
- *J* VALUE IS CONSIDERED ESTIMATED DUE TO EXCEEDANCE OF TECHNICAL QUALITY CONTROL CRITERIA OR BECAUSE RESULT IS LESS THAN THE CONTRACT REQUIRED QUANTITATION LIMIT (CRQL)
- CEA BOUNDARY

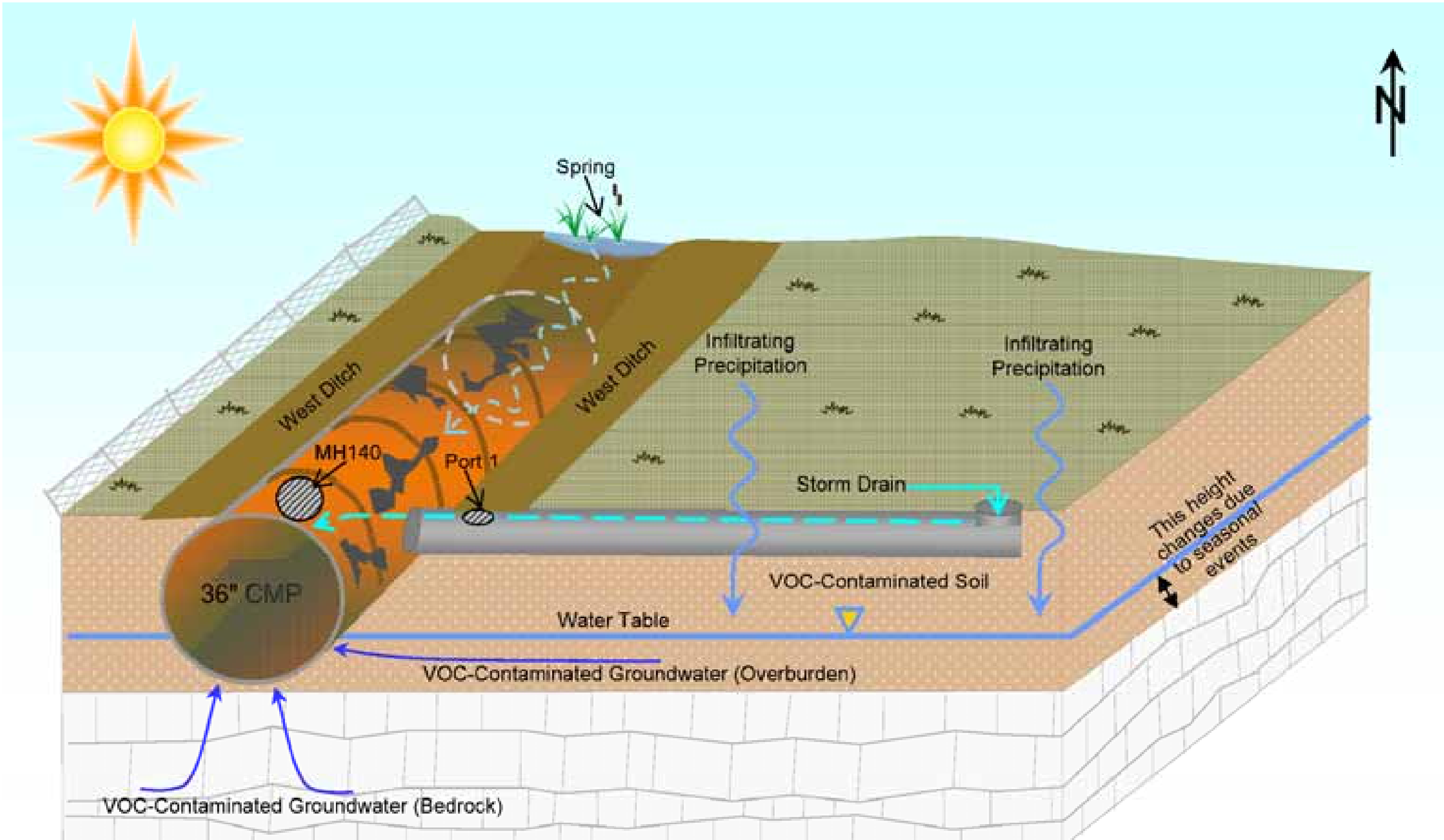
NOTE:
ALL SAMPLES WERE COLLECTED IN MAY AND JUNE OF 2007.

0 300 600
SCALE IN FEET

TETRA TECHNUS, INC.

BEDROCK GROUNDWATER CONCENTRATIONS ABOVE CURRENT REGULATORY CRITERIA
NAVAL AIR WARFARE CENTER
TRENTON, NEW JERSEY

FILE	SCALE
112G02311GM06-1	AS NOTED
FIGURE NUMBER: FIGURE 9	REV: 0 DATE: 07/15/11



LEGEND

- Water Table
- Soil
- Bedrock
- Infiltrating Precipitation
- Property Fenceline
- Soil and Grass Cover
- Phragmites
- Manhole Cover

TETRA TECH NUS, INC.

CONCEPTUAL SITE MODEL
NAWC TRENTON STORM SEWERS AND OUTFALLS
NAVAL AIR WARFARE CENTER
TRENTON, NEW JERSEY

SCALE	AS NOTED
FILE	112G02311CF02
REV	0
DATE	07/08/11
FIGURE NUMBER	FIGURE 10

APPENDIX A

HISTORICAL SITE INFORMATION

DEPARTMENT OF THE NAVY
BASE REALIGNMENT AND CLOSURE
PROGRAM MANAGEMENT OFFICE, NORTHEAST
4911 SOUTH BROAD STREET
PHILADELPHIA, PA 19112-1303

BPMO NE/JD
Ser 11-034
December 20, 2010

Ms. Donna L. Gaffigan
New Jersey Department of Environmental Protection
401 East State Street
P.O. Box 028
Trenton, NJ 08625

Dear Ms. Gaffigan:

This letter is submitted in response to the New Jersey Department of Environmental Protection (NJDEP) letter to the Navy dated May 24, 2010. In that letter, the NJDEP stated that contaminated groundwater from the former NAWC Trenton site continues to discharge into the Parkway Avenue storm sewer located immediately downgradient of the facility, and ultimately into the Gold Run surface water body. Because of this discharge, the current remedial action for groundwater fails to meet the applicable standards as required in N.J.A.C. 7:26E-1.3(c), specifically the Minimum Surface Water Remediation Standards identified in N.J.A.C. 7:26D-3.

While the NJDEP recognized that the Navy has taken numerous actions to identify, isolate and stop the continued discharge, the NJDEP requested that a Remedial Action Report (RAR) be submitted within 120 calendar days of the letter's receipt. The RAR is required pursuant to N.J.A.C. 7:26E-6.7 and is to summarize all of the Navy's activities related to identifying, isolating, and stopping the continued discharge of contaminated groundwater to the storm sewer and to Gold Run. In compliance with NJDEP's request, the Navy formally submitted the RAR to NJDEP on September 24, 2010.

In the same letter, the NJDEP further requested that within 90 calendar days of the submittal of the RAR, the Navy should submit a remedial action selection report pursuant to N.J.A.C. 7:26E-5.2 that evaluates and selects potential technologies to stop the infiltration, or if the Navy determines during this process that additional data are needed in order to properly evaluate the technologies, the Navy should instead submit a work plan for additional site investigation, along with a revised schedule to submit the remedial action selection report.

The purpose of this letter is to provide notification to the NJDEP of remedial steps the Navy will perform that should reduce the discharge of contaminated groundwater into the storm sewers and Gold Run from Outfall 1 (and the West Ditch drainage system), and to outline additional site investigation efforts that will be performed to identify the source of site-related contaminants of concern (COCs) in the discharged groundwater and evaluate potential changes to the site's hydrogeological regime that result from the proposed remedial action. The following paragraphs outline the Navy's proposed remedial steps.

1. **Evaluation and Repair of the Upper Segment of the West Ditch 36-inch Corrugated Metal Pipe (CMP)**

   The West Ditch storm sewer drainage line consists of a 370 foot upper segment (north of Manhole 140) and a 160 foot lower segment (south of Manhole 140; see Figure 1). In addition to collecting stormwater runoff from portions of the former base, this pipe also collects groundwater that emanates from an upgradient spring (see Figure 1). Groundwater is discharged from this spring during most of the year and enters the CMP at its headwall inlet. The spring water (groundwater) does not contain site-related COCs. The lower segment of the storm sewer was replaced in 1997, but the upper segment of the storm sewer is the original CMP and is apparently damaged or significantly deteriorated. As discussed in the RAR, the infiltration of contaminated groundwater into the older, upper segment of the West Ditch CMP and the subsequent discharge of this water through Outfall 1 (into the Navy storm sewer) has been identified as the primary contributor of site COCs to the storm sewer.

   The Navy will conduct a video survey of the 370 foot upper segment of the West Ditch CMP. In conjunction with the video survey, samples will be collected from a storm sewer lateral system that drains the area of Site 4 adjacent to Building 41. The video survey will evaluate the pipe condition and optimize repair or replacement of failed pipe sections or the entire pipe, if necessary. Results from the storm sewer lateral system will be evaluated to determine if this lateral system is a source of contaminated water into the West Ditch. In any case, the repair of the CMP should mitigate infiltration of contaminated groundwater into the pipe, will prevent the mixing of contaminated groundwater with the uncontaminated spring water that flows into the pipe's inlet, and should immediately result in the elimination of the majority of site-related COCs from Outfall 1.

2. **Additional Site Investigation in the Vicinity of the West Ditch**

   Although the repair of the upper segment of the West Ditch storm sewer will eliminate the discharge of a significant volume of site-related COCs into the Parkway sewer system, the Navy recognizes that additional data gaps will either remain after this repair, or potentially be created by this repair. These data gaps include:

- *Contaminated Groundwater Source:* The source of the contaminated groundwater that is currently infiltrating the CMP is not completely understood. For example, the source may be from precipitation that migrates through contaminated soil and infiltrates damaged segments of the storm sewer as overburden groundwater; it may be contaminated bedrock groundwater that discharges upward and into the storm sewer from below; it may be water discharging into the sewer from a lateral line that enters the West Ditch CMP from the east; or it may be a combination of any or all of these potential sources.

- *Changed Hydrogeologic Conditions:* Repair of the CMP is expected to change the hydrogeological regime in the immediate vicinity of the West Ditch by eliminating the infiltration of groundwater into the CMP and removing what can be considered a highly transmissive migration pathway from the overburden aquifer system. At this time, the Navy envisions replacement of the CMP and subsequent backfilling of the excavated trench with permeable sand and gravel which should maintain this preferential transmissive pathway. It is possible that a reduction (or elimination) of overburden groundwater migrating along the West Ditch may increase the overburden groundwater levels east of the ditch and increase the groundwater flux through the overburden in the southern portion of the site, where the overburden is typically unsaturated. Increased groundwater flow through the overburden in the vicinity of Parkway Avenue is of concern because it could potentially increase the possibility of off-site migration of site-related COCs through the overburden and into segments of the Parkway Avenue storm sewers (which the Navy does not currently believe is a significant pathway) rather than the documented present direct discharge through the site's storm sewer system.

To address these data gaps, the Navy plans to perform additional site investigation activities concurrent with, and subsequent to, the repair of the upper segment of the West Ditch CMP. Although the details of this work are still being developed, the general scope of the activities and the conditions they are intended to address are as follows:

- The soil that is excavated along the upper segment of the West Ditch will be screened to determine its quality and to assess whether site-related contamination of the soils in the immediate vicinity of the ditch are a source of the COCs that have been discharging via Outfall 1 into the Parkway storm sewer.

- A series of piezometers will be installed within the proposed backfill to determine groundwater elevation and groundwater quality of the overburden groundwater in the immediate vicinity of the West Ditch, and to assess whether overburden groundwater is a source of the COCs that have been discharging into the Parkway storm sewer.

- Overburden monitoring wells located south (downgradient) of Manhole 140 will be measured for groundwater elevation and periodically sampled, to determine if the elimination of the preferred off-site migration pathway through the damaged CMP has created a new migration pathway through the overburden medium. In conjunction with this, the Navy will indefinitely delay sealing overburden wells (MW-1S, MW-4S, MW-17S, MW-41S, and MW-26BR) near the West Ditch that the NJDEP previously approved for sealing.

Details of the investigation activities will be developed in cooperation with the NJDEP in a Work Plan prepared in accordance with *Uniform Federal Policy for Quality Assurance Project Plans (UFP -QAPP)* and will outline the investigation objectives, sampling design and rationale, locations, and methods.

The Navy expects that repairs to the upper segment of the West Ditch sewer will be effective and will mitigate the discharge of nearly all of the COCs into the Parkway storm sewer. If the permeable backfill within the repaired trench is found to be a collection zone and migration pathway for contaminated overburden groundwater, multiple remedial technologies are available and will be considered by the Navy, such as in-situ treatment (for example, a zero-valent iron trench) or groundwater extraction and treatment. If groundwater flux through the overburden to the south is increased, the Navy believes that most of this groundwater will be induced to infiltrate the shallow bedrock as it migrates through the vicinity of the in-place groundwater extraction system, where it will be captured and treated by the current groundwater pump-and-treat system. If monitoring indicates that impacted overburden groundwater in the immediate area of the West Ditch is not being extracted or removed, the extraction system can be optimized to increase extraction at key locations or depths. However, none of these potential technologies can be implemented (or even fully evaluated) until the West Ditch CMP line is repaired and the effects of the repair have been analyzed.

The Navy proposes the following schedule for the West Ditch CMP repair and/or replacement and draft Work Plan submittal:

ITEM	**DATE**
West Ditch CMP Video Survey and Stormwater Sampling (PORT 001)	March 22, 2011
DRAFT Groundwater Infiltration Investigation Work Plan	April 19, 2011
West Ditch CMP Pipe Repair/Replacement	Based on results of video survey

Should you have any questions or comments, or wish to discuss this proposed action, please contact me at 215-897-4908 or Jeff Dale at 215-897-4914.

Sincerely,

Robert F. Lewandowski
BRAC Environmental Coordinator
By direction of BRAC PMO

Copy to:
William Hanrahan, NJDEP/BGWPA
Lori Stopyra, Nassimi Realty
Jeff Dale, NAVFAC Midlant
Pierre Lacombe, USGS
Robert Hare, Motors Liquidators
Kevin Kilmartin, Tetra Tech
Mary Mang, Tetra Tech
Glenn Wagner, Tetra Tech

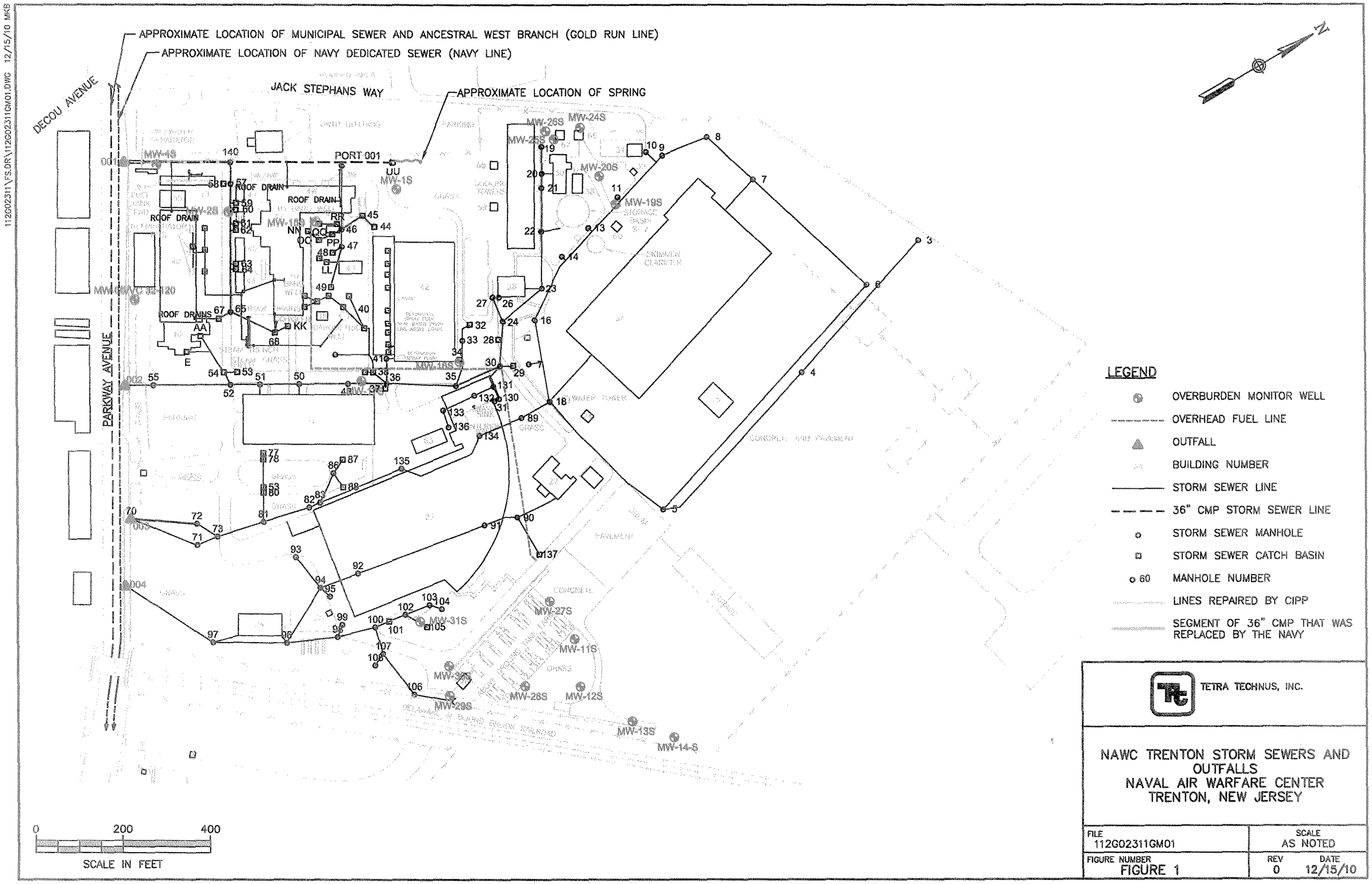

112G02311\FS_DR\112G02311GM01.DWG 12/15/10 MKB
APPROXIMATE LOCATION OF MUNICIPAL SEWER AND ANCESTRAL WEST BRANCH (GOLD RUN LINE)
APPROXIMATE LOCATION OF NAVY DEDICATED SEWER (NAVY LINE)
APPROXIMATE LOCATION OF SPRING
JACK STEPHANS WAY
DECOU AVENUE
PARKWAY AVENUE
PORT 001
ROOF DRAIN
MW-1S
MW-2S
MW-4S
MW-11S
MW-12S
MW-13S
MW-14-S
MW-16S
MW-18S
MW-19S
MW-20S
MW-24S
MW-25S
MW-26S
MW-27S
MW-28S
MW-29S
MW-31S
WATER TOWER
CONCRETE AND PAVEMENT
PAVEMENT
GRASS
LEGEND
OVERBURDEN MONITOR WELL
OVERHEAD FUEL LINE
OUTFALL
BUILDING NUMBER
STORM SEWER LINE
36" CMP STORM SEWER LINE
STORM SEWER MANHOLE
STORM SEWER CATCH BASIN
60 MANHOLE NUMBER
LINES REPAIRED BY CIPP
SEGMENT OF 36" CMP THAT WAS REPLACED BY THE NAVY
0 200 400
SCALE IN FEET
N
TETRA TECHNUS, INC.
NAWC TRENTON STORM SEWERS AND OUTFALLS
NAVAL AIR WARFARE CENTER
TRENTON, NEW JERSEY
FILE 112G02311GM01
SCALE AS NOTED
FIGURE NUMBER FIGURE 1
REV 0
DATE 12/15/10

TABLE 1

SUMMARY OF GROUNDWATER ANALYTICAL RESULTS
MARCH 2011
NAWC TRENTON
WEST TRENTON, NEW JERSEY

Sample ID	Date Collected	Acetone	Benzene	Chloro-methane	1,1-DCA	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	TCE	Vinyl Chloride
NJDEP GWQS		*6,000*	*1*	*3*	*50*	*1*	*70*	*100*	*1*	*1*
8BR	3/8/2011	10.0 U	1.0 U	1.0 U	1.0 U	1.0 U	20.5	1.0 U	**62.3**	1.0 U
15BR	3/8/2011	50.0 U	5.0 U	5.0 U	5.0 U	**22.8**	**3,510**	37.5	**2,790**	**214**
20BR	3/8/2011	50.0 U	5.0 U	5.0 U	5.0 U	**27.1**	**8,910**	41.2	**1,340**	**1,340**
DUP-1 (20BR)	3/8/2011	10.0 U	1.0 U	1.0 U	0.41 J	**30.3**	**9,110**	41.5	**1,330**	**1,450**
22BR	3/8/2011	10.0 U	1.0 U	1.0 U	1.0 U	1.0 U	16.6	1.0 U	**7.7**	1.0 U
29BR	3/8/2011	50.0 U	5.0 U	5.0 U	5.0 U	**5.8**	**1,300**	12.6	**23.3**	**2.0 J**
45BR	3/8/2011	50.0 U	5.0 U	5.0 U	5.0 U	**3.7 J**	**726**	6.2	**2,930**	**5.6**
48BR	3/8/2011	10.0 U	1.0 U	0.31 J	0.32 J	0.94 J	20.3	0.57 J	**147**	0.45 J
56BR	3/8/2011	5.1 J	0.39 J	1.0 U	1.0 U	1.0 U	6.1	1.0 U	**35.3**	1.0 U
BRP2	3/8/2011	10.0 U	0.38 J	1.0 U	1.1	**41.9**	**13,100**	61.0	**433**	**5,210**
WDW	3/8/2011	10.0 U	1.0 U	1.0 U	1.0 U	**3.1**	**203**	3.3	**619**	**4.3**
04S	DRY	NS	NS	NS	NS	NS	NS	NS	NS	NS
40S	3/8/2011	10.0 U	0.41 J	1.0 U	1.0 U	**14.6**	**6,020**	28.0	**90.4**	**584**
41S	3/8/2011	50.0 U	5.0 U	5.0 U	5.0 U	**2.2 J**	**402**	3.8 J	**82.6**	**13.0**

Notes:

All results given in micrograms per liter (µg/L).

Bold highlight indicates value equal to or exceeding the NJDEP GWQS.

DCA = dichloroethane

DCE = dichloroethene

PCE = tetrachloroethene

TCA = trichloroethane

TCE = trichloroethene

J = estimated value

U = compound analyzed for but not detected at the stated detection limit

DUP = duplicate field sample (location of duplicate in parentheses)

NJDEP GWQS = The New Jersey Department of Environmental Protection Ground Water Quality Standards for Class II-A Ground Water (N.J.A.C. 7:9C) last amended on 4 November 2009. The criteria used are the Higher of Practical Quantitiation Limits (PQLs) or the GWQS.

TABLE 2

SUMMARY OF SURFACE WATER ANALYTICAL RESULTS
MARCH 2011
NAWC TRENTON
WEST TRENTON, NEW JERSEY

Sample ID	Date Collected	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	1,1,1-TCA	TCE	Vinyl Chloride
NJDEP SWQS		*4.7*	*NSE*	*590*	*120*	*1.0*	*0.082*
GR-OF	3/9/2011	1.0 U	9.4	1.0 U	1.0 U	**6.0**	1.0 U
MH-117N	3/9/2011	1.0 U	12.6	1.0 U	1.0 U	**5.7**	1.0 U
DUP-2 (MH-117N)	3/9/2011	1.0 U	13.0	1.0 U	1.0 U	**5.7**	1.0 U
MH-117T	3/9/2011	0.50 J	95.0	0.61 J	1.0 U	**61.2**	**1.9**
MH-118.5N	3/9/2011	1.0 U	4.8	1.0 U	1.0 U	**3.3**	1.0 U
MH-118.5T	3/9/2011	0.44 J	112	0.84 J	1.0 U	**71.2**	**2.3**
MH-121.5N	3/9/2011	0.69 J	20.4	1.0 U	0.53 J	**10.1**	**0.32 J**
MH-121.5T	3/9/2011	0.85 J	183	1.3	1.0 U	**122**	**4.2**
MH-125.9N (OF-1D and OS Effluent)	3/9/2011	2.4	434	3.7	1.0 U	**516**	**8.5**
MH-125.9T	3/9/2011	1.0 U	4.8	1.0 U	1.0 U	**2.6**	1.0 U
OF1-A (Culvert)	3/9/2011	1.0 U	1.0 U	1.0 U	1.0 U	0.40 J	1.0 U
OF1-B (MH-140)	3/9/2011	2.9	179	2.9	1.0 U	**724**	**2.7**
OF1-C (OS Influent)	3/9/2011	3.4	178	3.3	1.0 U	**770**	**2.7**
Port 001	3/9/2011	1.0 U	1.2	1.0 U	1.0 U	**2.9**	1.0 U

Notes:

All results given in micrograms per liter (µg/L).

Bold highlight indicates value equal to or exceeding the NJDEP SWQS.

DCE = dichloroethene

TCE = trichloroethene

J = estimated value

U = compound analyzed for but not detected at the stated detection limit

DUP = duplicate field sample (location of duplicate in parentheses)

NS = Not sampled. Outfall was dry and could not be sampled.

NSE = no standard established

NJDEP SWQS = The New Jersey Department of Environmental Protection Surface Water Quality Standards for Class FW2 Surface Water (N.J.A.C. 7:9B-1.14(c)) readopted on 16 June 2009.

TABLE 3

SUMMARY OF SEDIMENT ANALYTICAL RESULTS
MARCH 2011
NAWC TRENTON
WEST TRENTON, NEW JERSEY

Sample ID	Date Collected	Total Mercury	Moisture (%)	Total Solids (%)
OF-4	3/9/2011	0.090 J	22.0	78.0
OF-3	3/9/2011	0.097 J	19.9	80.1
DUP-3 (OF-3)	3/9/2011	0.12	20.7	79.3
OF-2	3/9/2011	12.0	28.0	72.0
OF-1	3/9/2011	2.2	74.6	25.4

Notes:

All results given in milligrams/kilogram (mg/kg).

J = estimated value

U = compound analyzed for but not detected at the stated detection limit

DUP = duplicate field sample (location of duplicate in parentheses)

TABLE 4

SUMMARY OF GROUNDWATER WATER QUALITY MEASUREMENTS
AT TIME OF SAMPLING
MARCH 2011
NAWC TRENTON
WEST TRENTON, NEW JERSEY

Sample ID	Date Collected	Time Collected	Temperature (ºC)	pH (SU)	Specific Conductivity (μS/cm)	Dissolved Oxygen (mg/L)	ORP (mV)	Turbidity (NTU)
8BR	3/8/2011	1430	14.18	7.70	309	0.07	-97.60	18.2
15BR	3/8/2011	1135	11.54	6.97	397	7.99	-35.20	10.9
20BR	3/8/2011	1245	14.98	7.14	452	0.57	-39.90	10.8
22BR	3/8/2011	1445	14.89	6.96	202	4.81	30.20	11.96
29BR	3/8/2011	1310	14.11	8.66	222	8.36	-245.10	13.2
45BR	3/8/2011	1515	13.42	7.27	351	0.02	-87.60	3.78
48BR	3/8/2011	1330	13.21	7.58	280	4.37	-14.10	20.8
56BR	3/8/2011	1540	14.39	7.41	209	6.59	-4.90	32.90
BRP2	3/8/2011	1555	14.04	7.09	608	0.07	-30.9	20.53
WDW	3/8/2011	1410	9.56	7.05	464	8.53	63.0	10.23
04S	3/8/2011	DRY	NS	NS	NS	NS	NS	NS
40S	3/8/2011	0950	11.72	6.64	472	0.33	63.9	1.89
41S	3/8/2011	1100	8.56	6.77	285	6.74	121.7	21.4

Notes:

μS/cm = microsiemens per centimeter

mg/L = milligrams per liter

NTU = nephelometric turbidity units

ORP = oxidation reduction potential

mV = milivolt
ºC = degrees Celsius
SU = standard units

TABLE 5

COMPARISON OF ORIGINAL AND DUPLICATE SAMPLE RESULTS
MARCH 2011
NAWC TRENTON
WEST TRENTON, NEW JERSEY

Sample ID	Duplicate Sample ID	cis-1,2-DCE			TCE			Vinyl Chloride			Mercury		
		Original	Duplicate	RPD	Original	Duplicate	RPD	Original	Duplicate	RPD	Original	Duplicate	RPD
20BR	DUP-1	8,910	9,110	2.2%	1,340	1,330	0.75%	1,340	1,450	7.89%	NA	NA	NC
MH-117N	DUP-2	12.6	13.0	3.1%	5.7	5.7	0.00%	ND	ND	NC	NA	NA	NC
OF-3	DUP-3	NA	NA	NC	NA	NA	NC	NA	NA	NC	0.097 J	0.12	**21%**

Notes:

All results given in micrograms per liter (µg/L).

RPD = relative percent difference

J = estimated value

U = compound analyzed for but not detected at the stated detection limit

NA = Not applicable

NC = Not calculated

ND= Non-Detect

DCE = dichloroethene

TCE = trichloroethene

Bold highlight indicates value equal to or exceeding the RPD guideline of 20%.

State of New Jersey

CHRIS CHRISTIE
Governor

KIM GUADAGNO
Lt. Governor

DEPARTMENT OF ENVIRONMENTAL PROTECTION
Bureau of Case Management
401 East State Street
P.O. Box 420 Mail Code 401-05
Trenton, NJ 08625-0420

BOB MARTIN
Commissioner

Robert F. Lewandowski
US Navy, BRAC PMO Northeast
4911 South Broad Street, Bldg 679, PNBC
Philadelphia, PA 19112-1303

March 1, 2011

Approval

Re: West Ditch Proposal
Naval Air Warfare Center -Trenton
1440 Parkway Avenue
Ewing Township, Mercer County
SRP PI# 006048
Activity Number Reference: RPC000004

Dear Mr. Lewandowski:

The New Jersey Department of Environmental Protection (Department) has completed its review of your December 20, 2010 letter discussing the Navy's proposed remedial steps to reduce the discharge of contaminated groundwater into the storm sewers and Gold Run from Outfall 1 (and the West Ditch drainage system), and outlining additional site investigation efforts to identify the source of the site-related contaminants of concern (COCs) in the discharged groundwater and evaluate potential changes to the site's hydrogeological regime that could result form the proposed remedial actions.

Specific activities include:

1. Video survey of the West Ditch 36-inch corrugated metal pipe (CMP) and subsequent repair/replacement of damaged sections,
2. Sampling of the storm sewer lateral system that drains the West Ditch area,
3. Soil sampling in the vicinity of the West Ditch to determine if soil is a continuing source of COCs,
4. Installation of piezometers in the proposed backfill to determine groundwater elevation and groundwater quality,
5. Sampling of existing overburden monitoring wells to determine if any changes to the corrugated metal pipe have created a new migration pathway through the overburden material.

The Navy proposes the following schedule for the West Ditch CMP repair/replacement, stormwater sampling and submittal of a Draft Groundwater Infiltration Work Plan:

Video Survey and Stormwater Sampling	March 22, 2011
Draft Groundwater Infiltration Investigation Work Plan	April 19, 2011
West Ditch CMP Repair/Replacement	Based on results of video survey

The Department has determined that the Navy's proposal is acceptable. The Department hereby approves the Navy's proposal, effective the date of this letter.

The Navy shall conduct the identified activities pursuant to the approved schedule. Please submit the Draft Groundwater Infiltration Investigation Work Plan by April 19, 2011, or submit a written request for an extension at least 2 weeks prior to the due date. Failure to submit the Work Plan in accordance with the schedule may result in the initiation of enforcement action. For your convenience, the regulations concerning the Department's remediation requirements can be found at http://www.state.nj.us/dep/srp/regs/.

If you require copies of Department Guidance Documents or applications, many of these are available on the internet http://www.state.nj.us/dep/srp. If you have any questions regarding this matter contact me by telephone at (609)633-1494 or by email at donna.gaffigan@dep.state.nj.us prior to the date indicated.

Sincerely,

Donna L Gaffigan

Donna L. Gaffigan, Case Manager
Bureau of Case Management

C: Jeffrey Dale, NAVFAC Midlant
Lori Stopyra, Nassimi Realty
Pierre Lacombe, USGS
Steven Elliot, Ewing Township Clerk
W. Allen Lee, III, HO Ewing Township Dept of Health & Vital Stats
Jessica Mollin, USEPA/Special Projects Branch
William Hanrahan, NJDEP/BGWPA

NATIONAL WATER MAIN CLEANING CO.

Specializing in today's needs for environmental protection.

CLOSED CIRCUIT TELEVISION INSPECTION OF SEWERS

Watermark Enviornmental, Inc.
West Ditch
Ewing, NJ
WAT009-1
(TV-26) DVD01

The Environmental
Protection Specialists

National National Water Main Cleaning Co.
875 Summer Ave
Newark, NJ 07104
Tel: 973-483-3200, Fax: 973-483-5065

Defect Grade Description

Project name:	Project number:	Contact:	Date:
SEWER CLEANING AND TV	WAT009-1		20110610

1:	Failure unlikely in the forseeable future. EXCELLENT: MINOR DEFECTS.
2:	Pipe unlikely to fail for at least 20 years. GOOD: DEFECTS THAT HAVE NOT BEGUN TO DETERIORATE.
3:	Pipe may fail in 10 to 20 years. FAIR: MODERATE DEFECTS THAT WILL CONTINUE TO DETERIORATE.
4:	Pipe will probably fail in 5 to 10 years. POOR: SEVERE DEFECTS THAT WILL BECOME GRADE 5 DEFECTS WITHIN THE FORSEEABLE FUTRE.
5:	Pipe has failed or will likely fail within the next 5 years. IMMEDIATE ATTENTION: DEFECTS REQUIRING IMMEDIATE ATTENTION.

Watermark Environmental, Inc.

The Environmental Protection Specialists

National National Water Main Cleaning Co.
875 Summer Ave
Newark, NJ 07104
Tel: 973-483-3200, Fax: 973-483-5065

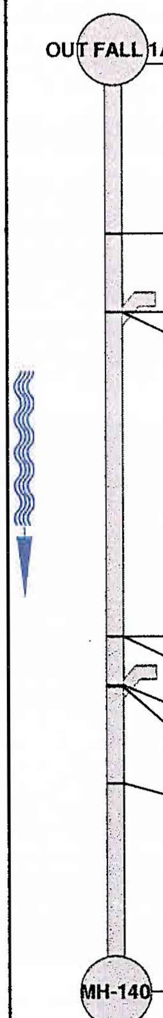
Inspection report

Date:	P.O.#:	Weather:	Surveyed By:	section number:	PSR:
06/10/2011	**WAT009-1**	**1 Dry**	**DANNY C**	**1**	
Total Pipe Length:	Survey Customer: **WATER MARK**	System Owner: **U.S. NAVY**	Clean Date:	Pre-Cleaned: **NONE**	rate:

Street:	**WEST DITCH**	Flow Control:		Start MH:	**OUT FALL 1A**
City:	**EWING, NJ**	Year Renewed		End MH:	**MH-140**
Location Code:		Tape/Media #:	**DVD01 TV-26**	pipe length:	**324.42 ft**

Reason for inspection:	**B Infiltration/Inflow Investigation**	Dia/Height:	**C Circular 36"/36"**
Use of Sewer:		Material:	**CMP Corrugated Metal Pipe** Pipe Length:
Drain. Area:		Lining Method:	
		Category:	

Remark::



1:750	position	code	observation	grade	counter	photo
OUT FALL 1A	5.00	MGO	General Observation, within 8 inch: NO, Remark: OUTFALL		00:00:00	
	63.36	MGO	General Observation		00:00:00	2a
	90.39	TBA	Tap Break-In Active, at 09 o´clock, 10", within 8 inch: NO		00:00:00	
	90.39	MGO	General Observation, within 8 inch: YES, Remark: PORT-1		00:00:00	
	202.00	MGP	General Photo		00:00:00	5a
	202.00	IG	Infiltration Gusher, at 04 o´clock, within 8 inch: NO	M 5	00:00:00	
	218.72	TBA	Tap Break-In Active, at 09 o´clock, 8", within 8 inch: NO		00:00:00	
	219.32	HVV	Hole Void Visible, from 04 to 08 o´clock, within 8 inch: NO	S 5	00:00:00	8a
	252.45	MWLS	Water Level, Sag in pipe, 3 in of cross sectional area	M 2	00:00:00	
MH-140	324.42	MGO	General Observation		00:00:00	

QSR	QMR	SPR	MPR	OPR	SPRI	MPRI	OPRI
5100	5121	5	7	12	5	3.5	4

The Environmental Protection Specialists

National National Water Main Cleaning Co.
875 Summer Ave
Newark, NJ 07104
Tel: 973-483-3200, Fax: 973-483-5065

Inspection photos

City:	Street:	Date:	section number:	PSR:
EWING, NJ	WEST DITCH	06/10/2011	1	

Photo: 2a, Tape/Media No.: DVD01 TV-26, 00:00:00
63.36FT, General Observation

Photo: 5a, Tape/Media No.: DVD01 TV-26, 00:00:00
202FT, General Photo

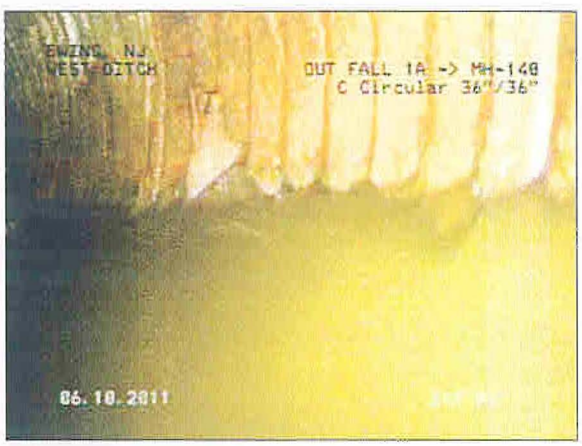


Photo: 8a, Tape/Media No.: DVD01 TV-26, 00:00:00
219.32FT, Hole Void Visible, from 04 to 08 o´clock, within 8 inch: NO

NATIONAL WATER MAIN CLEANING CO.
Specializing in today's needs for environmental protection.
875 Summer Ave. • Newark, NJ 07104-3684 • (973) 483-3200 • Fax (973) 483-5065 • E-Mail: office@nwmcc.com
8 B Street • Hyde Park, MA 02136-2606 • (617) 361-5533 • Fax (617) 361-5501 • E-Mail: boston@nwmcc.com

APPENDIX B

SITE-SPECIFIC FIELD FORMS

Tetra Tech

BORING LOG

PROJECT NAME: ______________________ BORING No.: ______________________
PROJECT NUMBER: ______________________ DATE: ______________________
DRILLING COMPANY: ______________________ GEOLOGIST: ______________________
DRILLING RIG: ______________________ DRILLER: ______________________

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION			USCS *	Remarks	PID/FID Reading (ppm)			
					Soil Density/ Consistency or Rock Hardness	Color	Material Classification			Sample	Sampler BZ	Borehole**	Driller BZ**

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): ______

Remarks: ____

Converted to Well: Yes ______ No ______ Well I.D. #: ______________________

Tetra Tech

CONTAINER SAMPLE & INSPECTION SHEET

Project Site Name: ________________
Project Number: __________________
Site Identification: _________________
Container Number(s): _____________
Sample Type: [] Grab
[] Composite

Sample ID No. ____________________
Sampled By: ______________________
C.O.C. No.: _______________________
Concentration: [] High
[] Medium
[] Low

CONTAINER SOURCE

DRUM:
- [] Bung Top
- [] Lever Lock
- [] Bolted Ring
- [] Other _______________

TANK:
- [] Plastic
- [] Metal
- [] Other _______________

OTHER: _________________

CONTAINER DESCRIPTION

COLOR: _____________________________

CONDITION: _________________________

MARKINGS: __________________________

VOL. OF CONTENTS: _________________

OTHER: ______________________________

CONTAINER DISPOSITION

SAMPLED: __________________

OPENED BUT NOT SAMPLED:
Reason _____________________
____

NOT OPENED:
Reason _____________________
____

CONTENTS DESCRIPTION

SINGLE PHASED: ___________________________
____

MULTIPHASE :

	Layer 1	**Layer 2**	**Layer 3**
Phase (Sol. or Liq.)	_______	_______	_______
Color	_______	_______	_______
Viscosity	L, M or H	L, M or H	L, M orH
% of Total Volume	_______	_______	_______

MONITOR READING:

SAMPLE and /or INSPECTION DATE & TIME:
_________________________________HRS.
METHOD:_______________________________

SAMPLER(S) and / or INSPECTOR(S) SIGNATURE:

ANALYSIS:

Tetra Tech

PROJECT: ____________________ **JOB #:** ____________________
LOCATION: ____________________ **DATE:** ____________________
PROJECT MANAGER: ____________________ **FOL:** ____________________

DAILY ACTIVITIES CHECKLIST

Startup Checklist

Activity	Yes	No	N/A
Pertinent site activities/information entered into site logbook			
All onsite personnel listed in logbook			
Required medical information onsite for all workers (Tetra Tech and Subcontractors)			
Required MSDS's onsite			
Proper equipment calibrations performed (list equipment)			
1 ____________________			
2 ____________________			
3 ____________________			
4 ____________________			
Calibration logs filled out			
Tailgate H&S meeting held prior to beginning field activities			
Required work permits filled out/signed			
Required utility clearances obtained			
Required PPE onsite and in use			
Information required to be posted is in place			
(OSHA poster, hospital route, key phone numbers, etc.)			

Exit Checklist

Activity	Yes	No	N/A
Logbooks completely and comprehensively filled out			
Field forms complete and accounted for/properly filed			
Samples properly packaged/shipped			
COCs faxed to appropriate in-house personnel			
All equipment accounted for, on charge if needed, and properly secured			
All personnel accounted for			
Arrangements made for upcoming work (permits, clearances, equipment, etc.)			
Site properly secured			

Note - not all items listed apply to every job, and some additional requirements may apply on a job-specific basis.

Tetra Tech

DAILY ACTIVITIES RECORD

PROJECT NAME:		**PROJECT NUMBER:**	
CLIENT:		**LOCATION:**	
DATE:		**ARRIVAL TIME:**	
Tt PERSONNEL:		**DEPARTURE TIME:**	
CONTRACTOR:		**DRILLER:**	

ITEM	QUANTITY ESTIMATE	QUANTITY TODAY	PREVIOUS TOTAL QUANTITY	CUMULATIVE QUANTITY TO DATE

COMMENTS: ______________________________

____

____

____

APPROVED BY:

______________________________ ______________________________

TETRA TECH REPRESENTATIVE DRILLER

DATE: ______________

Tetra Tech

PROJECT: ____________________ LOCATION: ____________________

JOB & CTO #: ____________________ MOBILIZATION DATE: ____________________

PROJECT MANAGER: ____________________ RETURN DATE: ____________________

FIELD PROJECT DEMOBILIZATION CHECKLIST

TRAVEL

___ Airline reservations
___ Hotel reservations/BOQs
___ Vehicle rental
___ Itinerary
___ Phone/pager number

DRILLING/DPT/SURVEY

Subcontractor

___ POC phone #/address
___ Drill Specification RFP
___ Contact (time & place to meet)
___ Confirm subcontract w/ Tt Procurement
___ Health and Safety documentation for all personnel on site
___ Copy of Drillers license
___ Well / boring permits

Utilities (2 weeks lead time)

___ Contact Site POC (Date:_____________)
___ Contact Local "Call Before You Dig"
___ Utility Clearance Form

Forms

___ Boring logs / Test Pit logs
___ Well construction / development forms
___ Daily activity forms
___ IDW inventory
___ IDW drum labels
___ Chemical Inventory
___ MSDS's

EQUIPMENT MOBILIZATION

___ Equipment Requisition form completed / equipment ordered
___ 3rd Party rental / misc. equipment ordered
___ Equipment calibration forms
___ Span / calibration gas and regulator

SAMPLING

Forms

___ Sample log sheets
___ Low-flow purge data sheets
___ COC records
___ COC seals
___ Sample labels (from database group)

Laboratory

___ POC address/phone#
___ Order bottles / preservatives
___ Shipping address, also check Sat. address
___ Bottle & preservation req'ts from lab
___ ____________________

MISCELLANEOUS

Schedule

___ Plan field operations w/ Project manager

Documents for Field Program

___ Logbook(s)
___ Field Sampling plan
___ Health & Safety plan
___ Maps
___ H & S Guidance Manual

Authorization

___ Kick-off meeting held
___ Gov't rate letter
___ H&S/OSHA 40-hour certifcate
___ 8-Hour Refresher Training Certificate
___ Medical Clearance Letter
___ Supervisory Training Certificate
___ Health & Safety Clearance Letter
___ Full-size OSHA Poster

HYDROGEOLOGY EQUIPMENT

___ Slug test/pumping test forms
___ Groundwater elevation data sheets
___ Graph paper
___ Data Logger/transducer/data cable
___ Existing well construction & water level data
___ M-Scope, slug

SHIPPING

Forms

___ FedEx Airbills, local dropoff location & hours
___ FedEx Gov. Acct# (1771-8058-0)
___ Lab Shipping Labels
___ Warehouse Shipping Labels
___ Blank Labels

Supplies

___ Tape
___ Packing materials
___ Baggies, Large garbage bags

OTHER

___ Site POC name/phone #
___ Personnel information to POC
___ Mobilization schedule to POC
___ Site access authorizations
___ Field office / trailer arrangements made
___ Electric, phone hookups arranged
___ Steel-toed boots, safety glasses, & hard hat
___ First aid equipment
___ Insect repellent
___ ____________________
___ ____________________

Note - not all items listed apply to every job, and some additional requirements may apply on a job-specific basis.

Tetra Tech

PROJECT: ____________________ **LOCATION:** ____________________

JOB & CTO #: ____________________ **MOBILIZATION DATE:** ____________________

PROJECT MANAGER: ____________________ **RETURN DATE:** ____________________

FIELD PROJECT PRE-MOBILIZATION CHECKLIST

TRAVEL

- ___ Airline reservations
- ___ Hotel reservations/BOQs
- ___ Vehicle rental
- ___ Itinerary
- ___ Phone/pager number

DRILLING/DPT/SURVEY

Subcontractor

- ___ POC phone #/address
- ___ Drill Specification RFP
- ___ Contact (time & place to meet)
- ___ Confirm subcontract w/ TtNUS Procurement
- ___ Health and Safety documentation for all personnel on site
- ___ Copy of Drillers license
- ___ Well / boring permits

Utilities (2 weeks lead time)

- ___ Contact Site POC (Date:____________)
- ___ Contact Local "Call Before You Dig"
- ___ Utility Clearance Form

Forms

- ___ Boring logs / Test Pit logs
- ___ Well construction / development forms
- ___ Daily activity forms
- ___ IDW inventory
- ___ IDW drum labels
- ___ Chemical Inventory
- ___ MSDS's

EQUIPMENT MOBILIZATION

- ___ Equipment Requisition form completed / equipment ordered
- ___ 3rd Party rental / misc. equipment ordered
- ___ Equipment calibration forms
- ___ Span / calibration gas and regulator

SAMPLING

Forms

- ___ Sample log sheets
- ___ Low-flow purge data sheets
- ___ COC records
- ___ COC seals
- ___ Sample labels (from database group)

Laboratory

- ___ POC address/phone#
- ___ Order bottles / preservatives
- ___ Shipping address, also check Sat. address
- ___ Bottle & preservation req'ts from lab
- ___ ____________________

MISCELLANEOUS

Schedule

- ___ Plan field operations w/ Project manager

Documents for Field Program

- ___ Logbook(s)
- ___ Field Sampling plan
- ___ Health & Safety plan
- ___ Maps
- ___ H & S Guidance Manual

Authorization

- ___ Kick-off meeting held
- ___ Gov't rate letter
- ___ H&S/OSHA 40-hour certifcate
- ___ 8-Hour Refresher Training Certificate
- ___ Medical Clearance Letter
- ___ Supervisory Training Certificate
- ___ Health & Safety Clearance Letter
- ___ Full-size OSHA Poster

HYDROGEOLOGY EQUIPMENT

- ___ Slug test/pumping test forms
- ___ Groundwater elevation data sheets
- ___ Graph paper
- ___ Data Logger/transducer/data cable
- ___ Existing well construction & water level data
- ___ M-Scope, slug

SHIPPING

Forms

- ___ FedEx Airbills, local dropoff location & hours
- ___ FedEx Gov. Acct# (1771-8058-0)
- ___ Lab Shipping Labels
- ___ Warehouse Shipping Labels
- ___ Blank Labels

Supplies

- ___ Tape
- ___ Packing materials
- ___ Baggies, Large garbage bags

OTHER

- ___ Site POC name/phone #
- ___ Personnel information to POC
- ___ Mobilization schedule to POC
- ___ Site access authorizations
- ___ Field office / trailer arrangements made
- ___ Electric, phone hookups arranged
- ___ Steel-toed boots, safety glasses, & hard hat
- ___ First aid equipment
- ___ Insect repellent
- ___ ____________________
- ___ ____________________

Note - not all items listed apply to every job, and some additional requirements may apply on a job-specific basis.

Tetra Tech

QA SAMPLE LOG SHEET

Project Site Name: ____________ Sample ID Number: ____________
Project Number: ____________ Sampled By: ____________
Sample Location: ____________ C.O.C. Number: ____________
QA Sample Type:
[] Trip Blank [] Rinsate Blank
[] Source Water Blank [] Other Blank ____________

SAMPLING DATA:

Date: ____________
Time: ____________
Method: ____________

WATER SOURCE:

[] Laboratory Prepared [] Tap
[] Purchased [] Fire Hydrant
[] Other ____________

PURCHASED WATER INFORMATION (If Applicable as Source or Rinsate Water):

Product Name: ____________
Supplier: ____________
Manufacturer: ____________
Order Number: ____________
Lot Number: ____________
Expiration Date: ____________

RINSATE INFORMATION (If Applicable):

Media Type: ____________
Equipment Used: ____________
Equipment Type:
[] Dedicated
[] Reusable

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
Volatiles	Cool 4^oC & HCl		YES / NO
Semivolatiles	Cool 4^oC		YES / NO
Pesticide / PCB	Cool 4^oC		YES / NO
Metals	Cool 4^oC & HNO_3		YES / NO
Cyanide	Cool 4^oC & NaOH		YES / NO

OBSERVATIONS / NOTES:

Signature(s):

Tetra Tech

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: ______________________
Project No.: ______________________

[] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other: ______________________
[] QA Sample Type: ______________________

Sample ID No.: ______________________
Sample Location: ______________________
Sampled By: ______________________
C.O.C. No.: ______________________

Type of Sample:
[] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:			
Time:			
Method:			
Monitor Reading (ppm):			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings				
(Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

APPENDIX C

LABORATORY ACCREDITATION DOCUMENTATION

LABORATORY ACCREDITATION BUREAU

Certificate # L2219

Scope of Accreditation For CHEMTECH

284 Sheffield Street
Mountainside, NJ 07092
Divyajit Mehta
908-789-8900

In recognition of a successful assessment to ISO/IEC 17025:2005 and the requirements of the DoD Environmental Laboratory Accreditation Program (DoD ELAP) as detailed in the DoD Quality Systems Manual for Environmental Laboratories (DoD QSM v4.2) based on the National Environmental Laboratory Accreditation Conference Chapter 5 Quality Systems Standard (NELAC Voted Revision June 5, 2003), accreditation is granted to CHEMTECH to perform the following tests:

Accreditation granted through: **October 20, 2012**

Testing – Environmental

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/ECD	EPA 8081A,B	4,4`-DDD
GC/ECD	EPA 8081A,B	4,4`-DDE
GC/ECD	EPA 8081A,B	4,4`-DDT
GC/ECD	EPA 8081A,B	Aldrin
GC/ECD	EPA 8081A,B	alpha-BHC (alpha-Hexachlorocyclohexane)
GC/ECD	EPA 8081A,B	alpha Chlordane
GC/ECD	EPA 8081A,B	beta-BHC (beta-Hexachlorocyclohexane)
GC/ECD	EPA 8081A,B	Chlordane (tech.)
GC/ECD	EPA 8081A,B	delta-BHC
GC/ECD	EPA 8081A,B	Dieldrin
GC/ECD	EPA 8081A,B	Endosulfan I
GC/ECD	EPA 8081A,B	Endosulfan II
GC/ECD	EPA 8081A,B	Endosulfan sulfate
GC/ECD	EPA 8081A,B	Endrin aldehyde
GC/ECD	EPA 8081A,B	Endrin ketone
GC/ECD	EPA 8081A,B	Endrin
GC/ECD	EPA 8081A,B	gamma-BHC (Lindane gamma-Hexachlorocyclohexane)

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/ECD	EPA 8081A,B	gamma Chlordane
GC/ECD	EPA 8081A,B	Heptachlor epoxide
GC/ECD	EPA 8081A,B	Heptachlor
GC/ECD	EPA 8081A,B	Methoxychlor
GC/ECD	EPA 8081A,B	Toxaphene (Chlorinated camphene)
GC/ECD	EPA 8082/8082A	Aroclor-1016 (PCB-1016)
GC/ECD	EPA 8082/8082A	Aroclor-1221 (PCB-1221)
GC/ECD	EPA 8082/8082A	Aroclor-1232 (PCB-1232)
GC/ECD	EPA 8082/8082A	Aroclor-1242 (PCB-1242)
GC/ECD	EPA 8082/8082A	Aroclor-1248 (PCB-1248)
GC/ECD	EPA 8082/8082A	Aroclor-1254 (PCB-1254)
GC/ECD	EPA 8082/8082A	Aroclor-1260 (PCB-1260)
GC/ECD	EPA 8151A	2,4,5-T
GC/ECD	EPA 8151A	2,4-D
GC/ECD	EPA 8151A	Dalapon
GC/ECD	EPA 8151A	Dicamba
GC/ECD	EPA 8151A	Dinoseb
GC/ECD	EPA 8151A	Picloram
GC/ECD	EPA 8151A	Silvex (2,4,5-TP)
GC/FID	EPA 8015B/D	Diesel range organics (DRO)
GC/FID	EPA 8015B/D	Gasoline range organics (GRO)
GC/MS	EPA 8260B,C	1,1,1,2-Tetrachloroethane
GC/MS	EPA 8260B,C	1,1,1-Trichloroethane
GC/MS	EPA 8260B,C	1,1,2,2-Tetrachloroethane
GC/MS	EPA 8260B,C	1,1,2-Trichloroethane
GC/MS	EPA 8260B,C	1,1-Dichloroethane
GC/MS	EPA 8260B,C	1,1-Dichloroethylene
GC/MS	EPA 8260B,C	1,1-Dichloropropene
GC/MS	EPA 8260B,C	1,2,3-Trichlorobenzene
GC/MS	EPA 8260B,C	1,2,3-Trichloropropane
GC/MS	EPA 8260B,C	1,2,4-Trichlorobenzene

Certificate # L2219

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 8260B,C	1,2,4-Trimethylbenzene
GC/MS	EPA 8260B,C	1,2-Dibromo-3-chloropropane (DBCP)
GC/MS	EPA 8260B,C	1,2-Dibromoethane (EDB Ethylene dibromide)
GC/MS	EPA 8260B,C	1,2-Dichlorobenzene
GC/MS	EPA 8260B,C	1,2-Dichloroethane
GC/MS	EPA 8260B,C	1,2-Dichloropropane
GC/MS	EPA 8260B,C	1,3,5-Trimethylbenzene
GC/MS	EPA 8260B,C	1,3-Dichlorobenzene
GC/MS	EPA 8260B,C	1,3-Dichloropropane
GC/MS	EPA 8260B,C	1,4-Dichlorobenzene
GC/MS	EPA 8260B,C	2,2-Dichloropropane
GC/MS	EPA 8260B,C	2-Butanone (Methyl ethyl ketone MEK)
GC/MS	EPA 8260B,C	2-Chloroethyl vinyl ether
GC/MS	EPA 8260B,C	2-Chlorotoluene
GC/MS	EPA 8260B,C	2-Hexanone
GC/MS	EPA 8260B,C	4-Chlorotoluene
GC/MS	EPA 8260B,C	4-Methyl-2-pentanone (MIBK)
GC/MS	EPA 8260B,C	Acetone
GC/MS	EPA 8260B,C	Acrolein (Propenal)
GC/MS	EPA 8260B,C	Acrylonitrile
GC/MS	EPA 8260B,C	1,1,2-Trichlorotrifluoroethane
GC/MS	EPA 8260B,C	Allyl chloride (3-Chloropropene)
GC/MS	EPA 8260B,C	Benzene
GC/MS	EPA 8260B,C	Bromobenzene
GC/MS	EPA 8260B,C	Bromochloromethane
GC/MS	EPA 8260B,C	Bromodichloromethane
GC/MS	EPA 8260B,C	Bromoform
GC/MS	EPA 8260B,C	Carbon disulfide
GC/MS	EPA 8260B,C	Carbon tetrachloride
GC/MS	EPA 8260B,C	Chlorobenzene
GC/MS	EPA 8260B,C	Chloroethane

Certificate # L2219

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 8260B,C	Chloroform
GC/MS	EPA 8260B,C	cis-1,2-Dichloroethylene
GC/MS	EPA 8260B,C	cis-1,3-Dichloropropene
GC/MS	EPA 8260B,C	Dibromochloromethane
GC/MS	EPA 8260B,C	Dibromomethane
GC/MS	EPA 8260B,C	Dichlorodifluoromethane
GC/MS	EPA 8260B,C	Ethyl acetate
GC/MS	EPA 8260B,C	Ethyl methacrylate
GC/MS	EPA 8260B,C	Ethylbenzene
GC/MS	EPA 8260B,C	Hexachlorobutadiene
GC/MS	EPA 8260B,C	Isopropylbenzene
GC/MS	EPA 8260B,C	m+p-Xylenes
GC/MS	EPA 8260B,C	Methacrylonitrile
GC/MS	EPA 8260B,C	Methyl bromide (Bromomethane)
GC/MS	EPA 8260B,C	Methyl chloride (Chloromethane)
GC/MS	EPA 8260B,C	Methyl tert-butyl ether (MTBE)
GC/MS	EPA 8260B,C	Methylene chloride
GC/MS	EPA 8260B,C	Naphthalene
GC/MS	EPA 8260B,C	n-Butylbenzene
GC/MS	EPA 8260B,C	n-Propylbenzene
GC/MS	EPA 8260B,C	o-Xylene
GC/MS	EPA 8260B,C	p-Dioxane
GC/MS	EPA 8260B,C	p-Isopropyltoluene
GC/MS	EPA 8260B,C	sec-Butylbenzene
GC/MS	EPA 8260B,C	Styrene
GS/MS	EPA 8260B,C	Tert-butyl alcohol
GC/MS	EPA 8260B,C	tert-Butylbenzene
GC/MS	EPA 8260B,C	Tetrachloroethylene (Perchloroethylene)
GC/MS	EPA 8260B,C	Toluene
GC/MS	EPA 8260B,C	trans-1,2-Dichloroethylene
GC/MS	EPA 8260B,C	trans-1,3-Dichloropropylene

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 8260B,C	trans-1,4-Dichloro-2-butene
GC/MS	EPA 8260B,C	Trichloroethene (Trichloroethylene)
GC/MS	EPA 8260B,C	Trichlorofluoromethane
GC/MS	EPA 8260B,C	Vinyl acetate
GC/MS	EPA 8260B,C	Vinyl chloride
GC/MS	EPA 8260B,C	Xylene (total)
GC/MS	EPA 8270C,D	1,2,4,5-Tetrachlorobenzene
GC/MS	EPA 8270C,D	1,2,4-Trichlorobenzene
GC/MS	EPA 8270C,D	1,2-Dichlorobenzene
GC/MS	EPA 8270C,D	1,2-Diphenylhydrazine
GC/MS	EPA 8270C,D	1,3-Dichlorobenzene
GC/MS	EPA 8270C,D	1,4-Dichlorobenzene
GC/MS	EPA 8270C,D	2,3,4,6-Tetrachlorophenol
GC/MS	EPA 8270C,D	2,4,5-Trichlorophenol
GC/MS	EPA 8270C,D	2,4,6-Trichlorophenol
GC/MS	EPA 8270C,D	2,4-Dichlorophenol
GC/MS	EPA 8270C,D	2,4-Dimethylphenol
GC/MS	EPA 8270C,D	2,4-Dinitrophenol
GC/MS	EPA 8270C,D	2,4-Dinitrotoluene (2,4-DNT)
GC/MS	EPA 8270C,D	2,6-Dinitrotoluene (2,6-DNT)
GC/MS	EPA 8270C,D	2-Chloronaphthalene
GC/MS	EPA 8270C,D	2-Chlorophenol
GC/MS	EPA 8270C,D	2-Methyl-4,6-dinitrophenol
GC/MS	EPA 8270C,D	2-Methylnaphthalene
GC/MS	EPA 8270C,D	2-Methylphenol (o-Cresol)
GC/MS	EPA 8270C,D	2-Nitroaniline
GC/MS	EPA 8270C,D	2-Nitrophenol
GC/MS	EPA 8270C,D	3,3`-Dichlorobenzidine
GC/MS	EPA 8270C,D	3+4-Methylphenol
GC/MS	EPA 8270C,D	3-Nitroaniline
GC/MS	EPA 8270C,D	4-Bromophenyl phenyl ether

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270C,D	4-Chloro-3-methylphenol
GC/MS	EPA 8270C,D	4-Chloroaniline
GC/MS	EPA 8270C,D	4-Chlorophenyl phenylether
GC/MS	EPA 8270C,D	4-Nitroaniline
GC/MS	EPA 8270C,D	4-Nitrophenol
GC/MS	EPA 8270C,D	Acenaphthene
GC/MS	EPA 8270C,D	Acenaphthylene
GC/MS	EPA 8270C,D	Acetophenone
GC/MS	EPA 8270C,D	Aniline
GC/MS	EPA 8270C,D	Anthracene
GC/MS	EPA 8270C,D	Benzidine
GC/MS	EPA 8270C,D	Benzo(a)anthracene
GC/MS	EPA 8270C,D	Benzo(a)pyrene
GC/MS	EPA 8270C,D	Benzo(b)fluoranthene
GC/MS	EPA 8270C,D	Benzo(g,h,i)perylene
GC/MS	EPA 8270C,D	Benzo(k)fluoranthene
GC/MS	EPA 8270C,D	Benzoic acid
GC/MS	EPA 8270C,D	Benzyl alcohol
GC/MS	EPA 8270C,D	bis(2-Chloroethoxy)methane
GC/MS	EPA 8270C,D	bis(2-Chloroethyl) ether
GC/MS	EPA 8270C,D	bis(2-Chloroisopropyl) ether (2,2`-Oxybis(1-chloropropane))
GC/MS	EPA 8270C,D	bis(2-Ethylhexyl) phthalate (DEHP)
GC/MS	EPA 8270C,D	Butyl benzyl phthalate
GC/MS	EPA 8270C,D	Carbazole
GC/MS	EPA 8270C,D	Chrysene
GC/MS	EPA 8270C,D	Dibenz(a,h)anthracene
GC/MS	EPA 8270C,D	Dibenzofuran
GC/MS	EPA 8270C,D	Diethyl phthalate
GC/MS	EPA 8270C,D	Dimethyl phthalate
GC/MS	EPA 8270C,D	Di-n-butyl phthalate
GC/MS	EPA 8270C,D	Di-n-octyl phthalate

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270C,D	Diphenylamine
GC/MS	EPA 8270C,D	Fluoranthene
GC/MS	EPA 8270C,D	Fluorene
GC/MS	EPA 8270C,D	Hexachlorobenzene
GC/MS	EPA 8270C,D	Hexachlorobutadiene
GC/MS	EPA 8270C,D	Hexachlorocyclopentadiene
GC/MS	EPA 8270C,D	Hexachloroethane
GC/MS	EPA 8270C,D	Indeno(1,2,3-cd)pyrene
GC/MS	EPA 8270C,D	Isophorone
GC/MS	EPA 8270C,D	Naphthalene
GC/MS	EPA 8270C,D	Nitrobenzene
GC/MS	EPA 8270C,D	n-Nitrosodimethylamine
GC/MS	EPA 8270C,D	n-Nitrosodi-n-propylamine
GC/MS	EPA 8270C,D	n-Nitrosodiphenylamine
GC/MS	EPA 8270C,D	Pentachlorophenol
GC/MS	EPA 8270C,D	Phenanthrene
GC/MS	EPA 8270C,D	Phenol
GC/MS	EPA 8270C,D	Pyrene
GC/MS	EPA 8270C,D	Pyridine
HPLC	EPA 8330/8330A	1,3,5-Trinitrobenzene
HPLC	EPA 8330/8330A	1,3-Dinitrobenzene
HPLC	EPA 8330/8330A	2,4,6-Trinitrotoluene
HPLC	EPA 8330/8330A	2,4-Dinitrotoluene
HPLC	EPA 8330/8330A	2,6-Dinitrotoluene
HPLC	EPA 8330/8330A	2-Amino-4,6-Dinitrotoluene
HPLC	EPA 8330/8330A	2-Nitrotoluene
HPLC	EPA 8330/8330A	3-Nitrotoluene
HPLC	EPA 8330/8330A	4-Amino-2,6-Dinitrotoluene
HPLC	EPA 8330/8330A	4-Nitrotoluene
HPLC	EPA 8330/8330A	HMX
HPLC	EPA 8330/8330A	Nitrobenzene

Non-Potable Water		
Technology	**Method**	**Analyte**
HPLC	EPA 8330/8330A	RDX
HPLC	EPA 8330/8330A	Tetryl
Gravimetric	EPA 1664A	Oil & Grease
Gravimetric	EPA 1664A	Total Petroleum Hydrocarbons (TPH)
Gravimetric	EPA 9071B	Oil & Grease
IC	EPA 9056/9056A	Bromide
IC	EPA 9056/9056A	Chloride
IC	EPA 9056/9056A	Fluoride
IC	EPA 9056/9056A	Nitrate
IC	EPA 9056/9056A	Nitrite
IC	EPA 9056/9056A	O-phosphate
IC	EPA 9056/9056A	Sulfate
CVAA	EPA 7470A	Mercury
ICP	EPA 6010B,C	Aluminum
ICP	EPA 6010B,C	Antimony
ICP	EPA 6010B,C	Arsenic
ICP	EPA 6010B,C	Barium
ICP	EPA 6010B,C	Beryllium
ICP	EPA 6010B,C	Boron
ICP	EPA 6010B,C	Cadmium
ICP	EPA 6010B,C	Calcium
ICP	EPA 6010B,C	Chromium
ICP	EPA 6010B,C	Cobalt
ICP	EPA 6010B,C	Copper
ICP	EPA 6010B,C	Iron
ICP	EPA 6010B,C	Lead
ICP	EPA 6010B,C	Magnesium
ICP	EPA 6010B,C	Manganese
ICP	EPA 6010B,C	Molybdenum
ICP	EPA 6010B,C	Nickel
ICP	EPA 6010B,C	Potassium

Non-Potable Water		
Technology	**Method**	**Analyte**
ICP	EPA 6010B,C	Selenium
ICP	EPA 6010B,C	Silicon
ICP	EPA 6010B,C	Silver
ICP	EPA 6010B,C	Sodium
ICP	EPA 6010B,C	Thallium
ICP	EPA 6010B,C	Tin
ICP	EPA 6010B,C	Titanium
ICP	EPA 6010B,C	Vanadium
ICP	EPA 6010B,C	Zinc
ICP-MS	EPA 6020/6020A	Aluminum
ICP-MS	EPA 6020/6020A	Antimony
ICP-MS	EPA 6020/6020A	Arsenic
ICP-MS	EPA 6020/6020A	Barium
ICP-MS	EPA 6020/6020A	Beryllium
ICP-MS	EPA 6020/6020A	Boron
ICP-MS	EPA 6020/6020A	Cadmium
ICP-MS	EPA 6020/6020A	Calcium
ICP-MS	EPA 6020/6020A	Chromium
ICP-MS	EPA 6020/6020A	Cobalt
ICP-MS	EPA 6020/6020A	Copper
ICP-MS	EPA 6020/6020A	Iron
ICP-MS	EPA 6020/6020A	Lead
ICP-MS	EPA 6020/6020A	Magnesium
ICP-MS	EPA 6020/6020A	Manganese
ICP-MS	EPA 6020/6020A	Molybdenum
ICP-MS	EPA 6020/6020A	Nickel
ICP-MS	EPA 6020/6020A	Potassium
ICP-MS	EPA 6020/6020A	Selenium
ICP-MS	EPA 6020/6020A	Silicon
ICP-MS	EPA 6020/6020A	Silver
ICP-MS	EPA 6020/6020A	Sodium

Non-Potable Water		
Technology	**Method**	**Analyte**
ICP-MS	EPA 6020/6020A	Thallium
ICP-MS	EPA 6020/6020A	Tin
ICP-MS	EPA 6020/6020A	Titanium
ICP-MS	EPA 6020/6020A	Vanadium
ICP-MS	EPA 6020/6020A	Zinc
Preparation	**Method**	**Type**
ISE	EPA 9040C	Corrosivity (pH)
ISE	EPA 9040C	pH
pH Paper	EPA 9041A	pH
ISE	EPA 9050A	Conductivity
Physical	EPA 1010A	Ignitability
Titrimetric	EPA 9034	Sulfide
Probe21	EPA 9040C	pH
TOC	EPA 9060/9060A	Total organic carbon
Turbidimetric	EPA 9038	Sulfate
Preparation	EPA 3060A	Chromium VI
UV/VIS	EPA 7196A	Chromium VI
Distillation	EPA 9010C	Total cyanide
UV/VIS	EPA 9012B	Total cyanide
Distillation	EPA 9013	Total cyanide
UV/VIS	EPA 9065	Total phenolics
Organic Preparation	3510C	Separatory Funnel
Organic Preparation	3541	Automated Soxhlet Extraction
Clean Up	3620C	Florisil Cleanup
Clean Up	3630C	Silica Gel Cleanup
Clean Up	3640A	Gel-Permeation Cleanup
Clean Up	3660	Sulfur Cleanup
Inorganic Preparation	3050B	Hotblock
Inorganic Preparation	3010A	Hotblock
Volatile Organic Preparation	5030B	Purge and Trap
Distillation	9030B	Sulfide
Extraction/Titrimetric	9031	Sulfide

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
GC/ECD	EPA 8081A,B	4,4`-DDD
GC/ECD	EPA 8081A,B	4,4`-DDE
GC/ECD	EPA 8081A,B	4,4`-DDT
GC/ECD	EPA 8081A,B	Aldrin
GC/ECD	EPA 8081A,B	alpha-BHC (alpha-Hexachlorocyclohexane)
GC/ECD	EPA 8081A,B	alpha Chlordane
GC/ECD	EPA 8081A,B	beta-BHC (beta-Hexachlorocyclohexane)
GC/ECD	EPA 8081A,B	Chlordane (tech.)
GC/ECD	EPA 8081A,B	delta-BHC
GC/ECD	EPA 8081A,B	Dieldrin
GC/ECD	EPA 8081A,B	Endosulfan I
GC/ECD	EPA 8081A,B	Endosulfan II
GC/ECD	EPA 8081A,B	Endosulfan sulfate
GC/ECD	EPA 8081A,B	Endrin aldehyde
GC/ECD	EPA 8081A,B	Endrin ketone
GC/ECD	EPA 8081A,B	Endrin
GC/ECD	EPA 8081A,B	gamma-BHC (Lindane gamma-Hexachlorocyclohexane)
GC/ECD	EPA 8081A,B	gamma Chlordane
GC/ECD	EPA 8081A,B	Heptachlor epoxide
GC/ECD	EPA 8081A,B	Heptachlor
GC/ECD	EPA 8081A,B	Methoxychlor
GC/ECD	EPA 8081A,B	Toxaphene (Chlorinated camphene)
GC/ECD	EPA 8082/8082A	Aroclor-1016 (PCB-1016)
GC/ECD	EPA 8082/8082A	Aroclor-1221 (PCB-1221)
GC/ECD	EPA 8082/8082A	Aroclor-1232 (PCB-1232)
GC/ECD	EPA 8082/8082A	Aroclor-1242 (PCB-1242)
GC/ECD	EPA 8082/8082A	Aroclor-1248 (PCB-1248)
GC/ECD	EPA 8082/8082A	Aroclor-1254 (PCB-1254)
GC/ECD	EPA 8082/8082A	Aroclor-1260 (PCB-1260)
GC/ECD	EPA 8151A	2,4,5-T

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
GC/ECD	EPA 8151A	2,4-D
GC/ECD	EPA 8151A	Dalapon
GC/ECD	EPA 8151A	Dicamba
GC/ECD	EPA 8151A	Dinoseb
GC/ECD	EPA 8151A	Picloram
GC/ECD	EPA 8151A	Silvex (2,4,5-TP)
GC/FID	EPA 8015B/D	Diesel range organics (DRO)
GC/MS	EPA 8015B/D	GRO
GC/MS	EPA 8260B,C	1,1,1,2-Tetrachloroethane
GC/MS	EPA 8260B,C	1,1,1-Trichloroethane
GC/MS	EPA 8260B,C	1,1,2,2-Tetrachloroethane
GC/MS	EPA 8260B,C	1,1,2-Trichloroethane
GC/MS	EPA 8260B,C	1,1,2-Trichlorotrifluoroethane
GC/MS	EPA 8260B,C	1,1-Dichloroethane
GC/MS	EPA 8260B,C	1,1-Dichloroethylene
GC/MS	EPA 8260B,C	1,1-Dichloropropene
GC/MS	EPA 8260B,C	1,2,3-Trichlorobenzene
GC/MS	EPA 8260B,C	1,2,3-Trichloropropane
GC/MS	EPA 8260B,C	1,2,4-Trichlorobenzene
GC/MS	EPA 8260B,C	1,2,4-Trimethylbenzene
GC/MS	EPA 8260B,C	1,2-Dibromo-3-chloropropane (DBCP)
GC/MS	EPA 8260B,C	1,2-Dibromoethane (EDB Ethylene dibromide)
GC/MS	EPA 8260B,C	1,2-Dichlorobenzene
GC/MS	EPA 8260B,C	1,2-Dichloroethane
GC/MS	EPA 8260B,C	1,2-Dichloropropane
GC/MS	EPA 8260B,C	1,3,5-Trimethylbenzene
GC/MS	EPA 8260B,C	1,3-Dichlorobenzene
GC/MS	EPA 8260B,C	1,3-Dichloropropane
GC/MS	EPA 8260B,C	1,4-Dichlorobenzene
GC/MS	EPA 8260B,C	2,2-Dichloropropane

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
GC/MS	EPA 8260B,C	2-Butanone (Methyl ethyl ketone MEK)
GC/MS	EPA 8260B,C	2-Chloroethyl vinyl ether
GC/MS	EPA 8260B,C	2-Chlorotoluene
GC/MS	EPA 8260B,C	2-Hexanone
GC/MS	EPA 8260B,C	4-Chlorotoluene
GC/MS	EPA 8260B,C	4-Methyl-2-pentanone (MIBK)
GC/MS	EPA 8260B,C	Acetone
GC/MS	EPA 8260B,C	Acrolein (Propenal)
GC/MS	EPA 8260B,C	Acrylonitrile
GC/MS	EPA 8260B,C	Allyl chloride (3-Chloropropene)
GC/MS	EPA 8260B,C	Benzene
GC/MS	EPA 8260B,C	Bromobenzene
GC/MS	EPA 8260B,C	Bromochloromethane
GC/MS	EPA 8260B,C	Bromodichloromethane
GC/MS	EPA 8260B,C	Bromoform
GC/MS	EPA 8260B,C	Carbon disulfide
GC/MS	EPA 8260B,C	Carbon tetrachloride
GC/MS	EPA 8260B,C	Chlorobenzene
GC/MS	EPA 8260B,C	Chloroethane
GC/MS	EPA 8260B,C	Chloroform
GC/MS	EPA 8260B,C	Methylcyclohexane
GC/MS	EPA 8260B,C	m+p-xylene
GC/MS	EPA 8260B,C	o-xylene
GC/MS	EPA 8260B,C	cis-1,2-Dichloroethylene
GC/MS	EPA 8260B,C	cis-1,3-Dichloropropene
GC/MS	EPA 8260B,C	Dibromochloromethane
GC/MS	EPA 8260B,C	Dibromomethane
GC/MS	EPA 8260B,C	Dichlorodifluoromethane
GC/MS	EPA 8260B,C	Ethyl methacrylate
GC/MS	EPA 8260B,C	Ethylbenzene

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
GC/MS	EPA 8260B,C	Hexachlorobutadiene
GC/MS	EPA 8260B,C	Isopropylbenzene
GC/MS	EPA 8260B,C	Methacrylonitrile
GC/MS	EPA 8260B,C	Methyl bromide (Bromomethane)
GC/MS	EPA 8260B,C	Methyl chloride (Chloromethane)
GC/MS	EPA 8260B,C	Methyl tert-butyl ether (MTBE)
GC/MS	EPA 8260B,C	Methylene chloride
GC/MS	EPA 8260B,C	Naphthalene
GC/MS	EPA 8260B,C	n-Butylbenzene
GC/MS	EPA 8260B,C	n-Propylbenzene
GC/MS	EPA 8260B,C	p-Dioxane
GC/MS	EPA 8260B,C	p-Isopropyltoluene
GC/MS	EPA 8260B,C	sec-Butylbenzene
GC/MS	EPA 8260B,C	Styrene
GC/MS	EPA 8260B,C	tert-butyl alcohol
GC/MS	EPA 8260B,C	tert-Butylbenzene
GC/MS	EPA 8260B,C	Tetrachloroethylene (Perchloroethylene)
GC/MS	EPA 8260B,C	Toluene
GC/MS	EPA 8260B,C	trans-1,2-Dichloroethylene
GC/MS	EPA 8260B,C	trans-1,3-Dichloropropylene
GC/MS	EPA 8260B,C	trans-1,4-Dichloro-2-butene
GC/MS	EPA 8260B,C	Trichloroethene (Trichloroethylene)
GC/MS	EPA 8260B,C	Trichlorofluoromethane
GC/MS	EPA 8260B,C	Vinyl acetate
GC/MS	EPA 8260B,C	Vinyl chloride
GC/MS	EPA 8260B,C	Xylene (total)
GC/MS	EPA 8270C,D	1,2,4,5-Tetrachlorobenzene
GC/MS	EPA 8270C,D	1,2,4-Trichlorobenzene
GC/MS	EPA 8270C,D	1,2-Dichlorobenzene
GC/MS	EPA 8270C,D	1,2-Diphenylhydrazine

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270C,D	1,3-Dichlorobenzene
GC/MS	EPA 8270C,D	1,4-Dichlorobenzene
GC/MS	EPA 8270C,D	2,3,4,6-Tetrachlorophenol
GC/MS	EPA 8270C,D	2,4,5-Trichlorophenol
GC/MS	EPA 8270C,D	2,4,6-Trichlorophenol
GC/MS	EPA 8270C,D	2,4-Dichlorophenol
GC/MS	EPA 8270C,D	2,4-Dimethylphenol
GC/MS	EPA 8270C,D	2,4-Dinitrophenol
GC/MS	EPA 8270C,D	2,4-Dinitrotoluene (2,4-DNT)
GC/MS	EPA 8270C,D	2,6-Dinitrotoluene (2,6-DNT)
GC/MS	EPA 8270C,D	2-Chloronaphthalene
GC/MS	EPA 8270C,D	2-Chlorophenol
GC/MS	EPA 8270C,D	2-Methyl-4,6-dinitrophenol
GC/MS	EPA 8270C,D	2-Methylnaphthalene
GC/MS	EPA 8270C,D	2-Methylphenol (o-Cresol)
GC/MS	EPA 8270C,D	2-Nitroaniline
GC/MS	EPA 8270C,D	2-Nitrophenol
GC/MS	EPA 8270C,D	3,3`-Dichlorobenzidine
GC/MS	EPA 8270C,D	3+4-Methylphenol
GC/MS	EPA 8270C,D	3-Nitroaniline
GC/MS	EPA 8270C,D	4-Bromophenyl phenyl ether
GC/MS	EPA 8270C,D	4-Chloro-3-methylphenol
GC/MS	EPA 8270C,D	4-Chloroaniline
GC/MS	EPA 8270C,D	4-Chlorophenyl phenylether
GC/MS	EPA 8270C,D	4-Nitroaniline
GC/MS	EPA 8270C,D	4-Nitrophenol
GC/MS	EPA 8270C,D	Acenaphthene
GC/MS	EPA 8270C,D	Acenaphthylene
GC/MS	EPA 8270C,D	Acetophenone
GC/MS	EPA 8270C,D	Aniline

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270C,D	Anthracene
GC/MS	EPA 8270C,D	Aramite
GC/MS	EPA 8270C,D	Benzidine
GC/MS	EPA 8270C,D	Benzo(a)anthracene
GC/MS	EPA 8270C,D	Benzo(a)pyrene
GC/MS	EPA 8270C,D	Benzo(b)fluoranthene
GC/MS	EPA 8270C,D	Benzo(g,h,i)perylene
GC/MS	EPA 8270C,D	Benzo(k)fluoranthene
GC/MS	EPA 8270C,D	Benzoic acid
GC/MS	EPA 8270C,D	Benzyl alcohol
GC/MS	EPA 8270C,D	bis(2-Chloroethoxy)methane
GC/MS	EPA 8270C,D	bis(2-Chloroethyl) ether
GC/MS	EPA 8270C,D	bis(2-Chloroisopropyl) ether (2,2`-Oxybis(1-chloropropane))
GC/MS	EPA 8270C,D	bis(2-Ethylhexyl) phthalate (DEHP)
GC/MS	EPA 8270C,D	Butyl benzyl phthalate
GC/MS	EPA 8270C,D	Carbazole
GC/MS	EPA 8270C,D	Chrysene
GC/MS	EPA 8270C,D	Dibenz(a,h)anthracene
GC/MS	EPA 8270C,D	Dibenzofuran
GC/MS	EPA 8270C,D	Diethyl phthalate
GC/MS	EPA 8270C,D	Dimethyl phthalate
GC/MS	EPA 8270C,D	Di-n-butyl phthalate
GC/MS	EPA 8270C,D	Di-n-octyl phthalate
GC/MS	EPA 8270C,D	Diphenylamine
GC/MS	EPA 8270C,D	Fluoranthene
GC/MS	EPA 8270C,D	Fluorene
GC/MS	EPA 8270C,D	Hexachlorobenzene
GC/MS	EPA 8270C,D	Hexachlorobutadiene
GC/MS	EPA 8270C,D	Hexachlorocyclopentadiene
GC/MS	EPA 8270C,D	Hexachloroethane

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270C,D	Indeno(1,2,3-cd)pyrene
GC/MS	EPA 8270C,D	Isophorone
GC/MS	EPA 8270C,D	Naphthalene
GC/MS	EPA 8270C,D	Nitrobenzene
GC/MS	EPA 8270C,D	n-Nitrosodimethylamine
GC/MS	EPA 8270C,D	n-Nitroso-di-n-butylamine
GC/MS	EPA 8270C,D	n-Nitrosodi-n-propylamine
GC/MS	EPA 8270C,D	n-Nitrosodiphenylamine
GC/MS	EPA 8270C,D	Pentachlorophenol
GC/MS	EPA 8270C,D	Phenanthrene
GC/MS	EPA 8270C,D	Phenol
GC/MS	EPA 8270C,D	Pyrene
GC/MS	EPA 8270C,D	Pyridine
Gravimetric	EPA 1664A	Oil & Grease
Gravimetric	EPA 1664A	Total Petroleum Hydrocarbons (TPH)
HPLC	EPA 8330/8330A	1,3,5-Trinitrobenzene
HPLC	EPA 8330/8330A	1,3-Dinitrobenzene
HPLC	EPA 8330/8330A	2,4,6-Trinitrotoluene
HPLC	EPA 8330/8330A	2,4-Dinitrotoluene
HPLC	EPA 8330/8330A	2,6-Dinitrotoluene
HPLC	EPA 8330/8330A	2-Amino-4,6-Dinitrotoluene
HPLC	EPA 8330/8330A	2-Nitrotoluene
HPLC	EPA 8330/8330A	3-Nitrotoluene
HPLC	EPA 8330/8330A	4-Amino-2,6-Dinitrotoluene
HPLC	EPA 8330/8330A	4-Nitrotoluene
HPLC	EPA 8330/8330A	HMX
HPLC	EPA 8330/8330A	Nitrobenzene
HPLC	EPA 8330/8330A	RDX
HPLC	EPA 8330/8330A	Tetryl
Colorimetric	EPA 9012B	Total cyanide

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
CVAA	EPA 7471A,B	Mercury
Gravimetric	EPA 9071B	Oil & Grease
IC	EPA 9056/9056A	Nitrite
IC	EPA 9056/9056A	Nitrate
IC	EPA 9056/9056A	Bromide
IC	EPA 9056/9056A	Chloride
IC	EPA 9056/9056A	Fluoride
IC	EPA 9056/9056A	O-phosphate
ICP	EPA 6010B,C	Aluminum
ICP	EPA 6010B,C	Antimony
ICP	EPA 6010B,C	Arsenic
ICP	EPA 6010B,C	Barium
ICP	EPA 6010B,C	Beryllium
ICP	EPA 6010B,C	Boron
ICP	EPA 6010B,C	Cadmium
ICP	EPA 6010B,C	Calcium
ICP	EPA 6010B,C	Chromium
ICP	EPA 6010B,C	Cobalt
ICP	EPA 6010B,C	Copper
ICP	EPA 6010B,C	Iron
ICP	EPA 6010B,C	Lead
ICP	EPA 6010B,C	Magnesium
ICP	EPA 6010B,C	Manganese
ICP	EPA 6010B,C	Molybdenum
ICP	EPA 6010B,C	Nickel
ICP	EPA 6010B,C	Potassium
ICP	EPA 6010B,C	Selenium
ICP	EPA 6010B,C	Silicon
ICP	EPA 6010B,C	Silver
ICP	EPA 6010B,C	Sodium

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
ICP	EPA 6010B,C	Thallium
ICP	EPA 6010B,C	Tin
ICP	EPA 6010B,C	Titanium
ICP	EPA 6010B,C	Vanadium
ICP	EPA 6010B,C	Zinc
ICP-MS	EPA 6020/6020A	Aluminum
ICP-MS	EPA 6020/6020A	Antimony
ICP-MS	EPA 6020/6020A	Arsenic
ICP-MS	EPA 6020/6020A	Barium
ICP-MS	EPA 6020/6020A	Beryllium
ICP-MS	EPA 6020/6020A	Boron
ICP-MS	EPA 6020/6020A	Cadmium
ICP-MS	EPA 6020/6020A	Calcium
ICP-MS	EPA 6020/6020A	Chromium
ICP-MS	EPA 6020/6020A	Cobalt
ICP-MS	EPA 6020/6020A	Copper
ICP-MS	EPA 6020/6020A	Iron
ICP-MS	EPA 6020/6020A	Lead
ICP-MS	EPA 6020/6020A	Magnesium
ICP-MS	EPA 6020/6020A	Manganese
ICP-MS	EPA 6020/6020A	Molybdenum
ICP-MS	EPA 6020/6020A	Nickel
ICP-MS	EPA 6020/6020A	Potassium
ICP-MS	EPA 6020/6020A	Selenium
ICP-MS	EPA 6020/6020A	Silicon
ICP-MS	EPA 6020/6020A	Silver
ICP-MS	EPA 6020/6020A	Sodium
ICP-MS	EPA 6020/6020A	Thallium
ICP-MS	EPA 6020/6020A	Tin
ICP-MS	EPA 6020/6020A	Titanium

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
ICP-MS	EPA 6020/6020A	Vanadium
ICP-MS	EPA 6020/6020A	Zinc
Preparation	**Method**	**Type**
pH Paper	EPA 9041A	pH
Probe	EPA 9045C	pH
ISE	EPA 9040C	pH/Corrosivity
TOC	EPA 9060/9060A	Total organic carbon
Physical	EPA 1010A	Ignitability
Titrimetric	EPA 9034	Sulfide
Turbidimetric	EPA 9038	Sulfate
Physical	EPA 9095A,B	Paint Filter Liquids Test
Preparation	EPA 3060A	Chromium VI
UV/VIS	EPA 7196A	Chromium VI
Distillation	EPA 9010C	Total cyanide
UV/VIS	EPA 9012B	Total cyanide
Distillation	EPA 9013	Total cyanide
UV/VIS	EPA 9065	Total phenolics
Preparation	EPA 1311	Toxicity Characteristic Leaching Procedure
Preparation	EPA 1312	SPLP
Organic Preparation	3541	Automated Soxhlet Extraction
Clean Up	3620C	Florisil Cleanup
Clean Up	3630C	Silica Gel Cleanup
Clean Up	3640A	Gel-Permeation Cleanup
Clean Up	3660	Sulfur Cleanup
Inorganics Preparation	3050B	Hotblock
Volatile Organics Preparation	5035A	Closed System Purge and Trap
Organic Preparation	3580A	Waste dilution
Distillation	9030B	Sulfide
Extraction/Titrimetric	9031	Sulfide

Air		
Technology	**Method**	**Analyte**
GC/MS	TO-15	1,1,1-Trichloroethane
GC/MS	TO-15	1,1,2,2-Tetrachloroethane
GC/MS	TO-15	1,1,2-Trichloroethane
GC/MS	TO-15	1,1,2-Trichlorotrifluoroethane
GC/MS	TO-15	1,1-Dichloroethane
GC/MS	TO-15	1,1-Dichloroethene
GC/MS	TO-15	1,2,4-Trichlorobenzene
GC/MS	TO-15	1,2,4-Trimethylbenzene
GC/MS	TO-15	1,2-Dibromoethane
GC/MS	TO-15	1,2-Dichlorobenzene
GC/MS	TO-15	1,2-Dichloroethane
GC/MS	TO-15	1,2-Dichloropropane
GC/MS	TO-15	1,3,5-Trimethylbenzene
GC/MS	TO-15	1,3-Butadiene
GC/MS	TO-15	1,3-Dichlorobenzene
GC/MS	TO-15	1,4-Dichlorobenzene
GC/MS	TO-15	1,4-Dioxane
GC/MS	TO-15	2,2,4-Trimethylpentane
GC/MS	TO-15	2-Butanone
GC/MS	TO-15	2-Chlorotoluene
GC/MS	TO-15	2-Hexanone
GC/MS	TO-15	4-Ethyltoluene
GC/MS	TO-15	4-Methyl-2-Pentanone
GC/MS	TO-15	Acetone
GC/MS	TO-15	Allyl Chloride
GC/MS	TO-15	Benzene
GC/MS	TO-15	Benzyl Chloride
GC/MS	TO-15	Bromodichloromethane
GC/MS	TO-15	Bromoethene
GC/MS	TO-15	Bromoform
GC/MS	TO-15	Bromomethane

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Air		
Technology	**Method**	**Analyte**
GC/MS	TO-15	Carbon Disulfide
GC/MS	TO-15	Carbon Tetrachloride
GC/MS	TO-15	Chlorobenzene
GC/MS	TO-15	Chloroethane
GC/MS	TO-15	Chloroform
GC/MS	TO-15	Chloromethane
GC/MS	TO-15	cis-1,2-Dichloroethene
GC/MS	TO-15	cis-1,3-Dichloropropene
GC/MS	TO-15	Cyclohexane
GC/MS	TO-15	Dibromochloromethane
GC/MS	TO-15	Dichlorodifluoromethane
GC/MS	TO-15	Dichlorotetrafluoroethane
GC/MS	TO-15	Ethanol
GC/MS	TO-15	Ethyl Acetate
GC/MS	TO-15	Ethyl Benzene
GC/MS	TO-15	Heptane
GC/MS	TO-15	Hexachloro-1,3-Butadiene
GC/MS	TO-15	Hexane
GC/MS	TO-15	Isopropyl Alcohol
GC/MS	TO-15	m/p-Xylene
GC/MS	TO-15	Methyl methacrylate
GC/MS	TO-15	Methyl tert-Butyl Ether
GC/MS	TO-15	Methylene Chloride
GC/MS	TO-15	Naphthalene
GC/MS	TO-15	o-Xylene
GC/MS	TO-15	Propene
GC/MS	TO-15	Styrene
GC/MS	TO-15	t-1,3-Dichloropropene
GC/MS	TO-15	tert-butyl alcohol
GC/MS	TO-15	Tetrachloroethene
GC/MS	TO-15	Tetrahydrofuran

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Air		
Technology	**Method**	**Analyte**
GC/MS	TO-15	Toluene
GC/MS	TO-15	trans-1,2-Dichloroethene
GC/MS	TO-15	Trichloroethene
GC/MS	TO-15	Trichlorofluoromethane
GC/MS	TO-15	Vinyl Acetate
GC/MS	TO-15	Vinyl Chloride

Notes:

1) This laboratory offers commercial testing service.

Approved by: ______________________ Date: June 22, 2011

R. Douglas Leonard
Chief Technical Officer

Issued: 10/20/09 Revised: 10/28/09 Revised: 08/02/10 Revised: 8/11/10 Revised: 10/5/10 Revised: 11/11/10 Revised: 6/22/11

State of New Jersey
Department of Environmental Protection

Certifies That

Chemtech

Laboratory Certification ID # 20012

is hereby approved as a

Nationally Accredited Environmental Laboratory

to perform the analyses as indicated on the Annual Certified Parameter List
which must accompany this certificate to be valid

having duly met the requirements of the

Regulations Governing The Certification Of
Laboratories And Environmental Measurements N.J.A.C. 7:18 et. seq.

and

having been found compliant with the standards approved by the

The NELAC Institute

Expiration Date June 30, 2012

Joseph F. Aiello, Chief
Office of Quality Assurance

NJDEP is a NELAP Recognized Accreditation Body

This certificate is to be conspicuously displayed at the laboratory with the annual certified parameter list in a location on the premises visible to the public.
Consumers are urged to verify the laboratory's current accreditation status with the State of NJ, NELAP.